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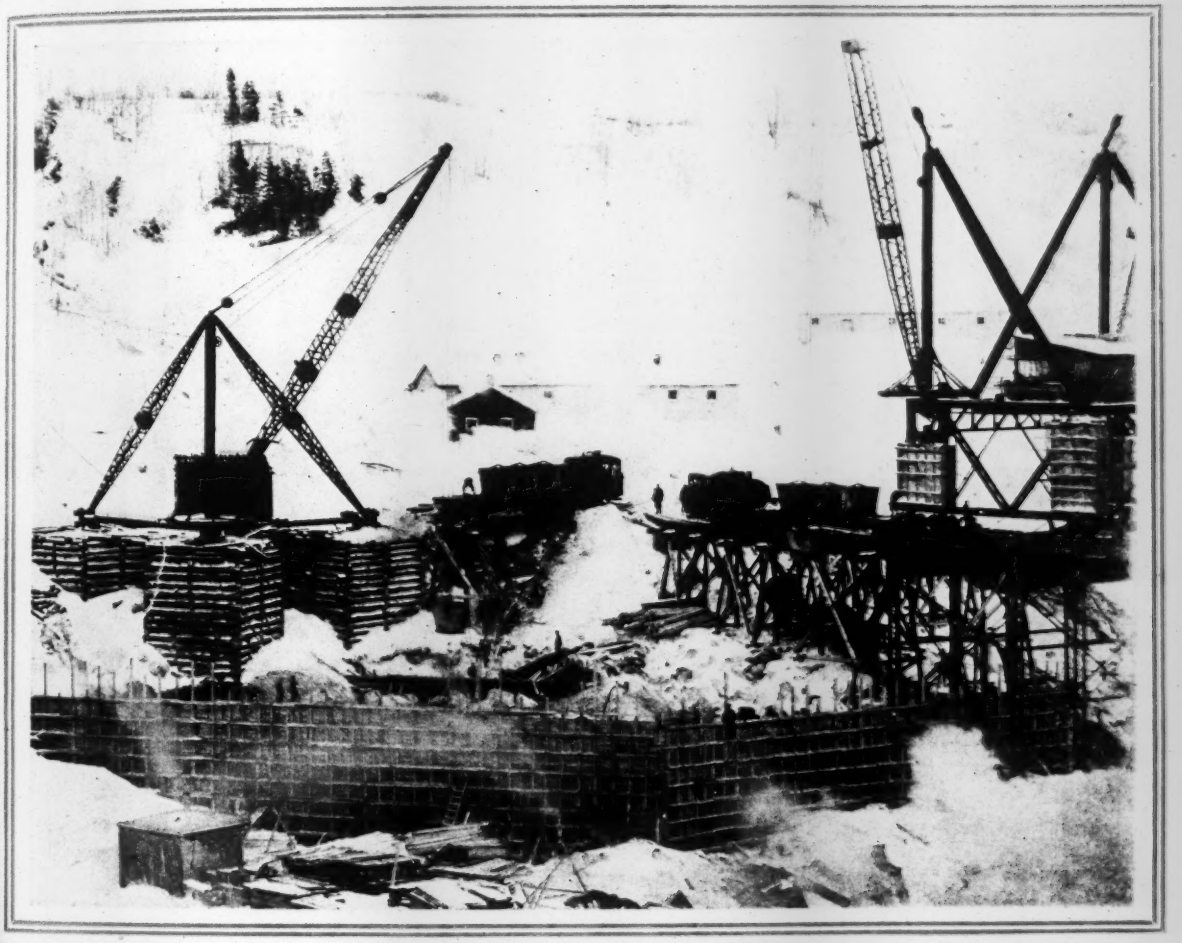

BELOW-ZERO CONSTRUCTION
Mid-Winter on the Saguenay Power Project

Trickling Filters at British Sewage-Works

Building a Hydro-Electric Plant on the Saguenay

Data on Gravel Road Corrugation

Winter Construction, III: *Methods and Costs*

Review of Latest Engineering Literature

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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Co-operative Publicity

TECHNICAL men in Dallas, Texas, have found a way to advertise themselves legitimately to their own city. Twenty-six of them including architects, chemists, civil engineers, a contractor and a geologist have gotten together in a campaign of local newspaper advertising over their names, the purpose of which is to tell the people of Dallas just what are the technical bases of the many municipal problems that the voter and the voter's representatives must settle. These advertisements are not personal to any of the subscribers but are educational; they tell what work is required to design and build a water-works system, what are the fundamentals of a street or highway policy, how much work and effort there is behind the turning on of an electric light, what are the essentials of an engineering education—in short, they aim to make the citizen realize that the engineer and his associates are more than artisans or selfish professionals but are thinking and working for the public good. There is need everywhere for such publicity. Dallas technicians have seen the light ahead of some of their fellows.

Rapid Transit by Water

RECOLLECTIONS of old Sam Pepys are aroused by the proposal to supplement the already conglomerate rapid-transit facilities of London by fast motor-boats on the Thames. The meticulous diarist of Charles the Second's Admiralty Office used nearly every day to go back and forth to the City on barge or boat, then probably a faster vehicle than coach over rough and crooked streets. The streets are now straight and smooth and the vehicles fast and commodious—but there are too many of them and the river may come back. The proposal is not without interest to New York, situated as it is in relation to the Hudson River and Long Island Sound. To be sure, New York has a somewhat similar service in the ferry to Staten Island and the boat service to Atlantic Highlands; but there may be possibilities in the use of faster and less cumbersome boats to points up the Hudson River and along the Sound, both on the mainland and on Long Island.

Putting It to the Test

CHICAGO has taken a novel and courageous step in calling in twenty-five eminent engineers to pass upon the propriety of its stand in the matter of its sewage disposal problem. At first blush this would seem to be getting engineering advice wholesale, or at least by convention, but the move is really a most wise one. So far Chicago has gone its way in this great controversy satisfied in its righteousness. It has employed engineers who were not called in to express opinion but to make plans and if their opinions differed from the stand that Chicago had taken they were not free to express themselves. The distinguished body of engineers just retained is independent. The case for Chicago will doubtless be put before them but they by no means must approve it or get out. They will have to report and if individually, or collectively, they disapprove that disapproval will be a part of the report. Chicago thus shows herself sure of her ground. The report of the engineering commission, if favorable, will stregthen her case. But if it is unfavorable she will obviously have to shift to some new scheme or else put herself on record as being against the trend of engineering thought.

Highway Conferences

HIGHWAY engineers have a variety of offerings in the way of road conferences and conventions from which to choose during the next three months. Naming only those events that come at once to mind there are the asphalt conference at Louisville, the meeting of the American Society of Civil Engineers at Detroit, the highway research and the traffic safety conferences in Washington, the convention of state highway officials at San Francisco, the convention and exhibition of the road builders' association at Chicago and the meeting of the Mississippi Valley State Highway Officials. State conferences, road schools and meetings of highway transport engineers have not been counted and there will be several. At the lowest count there are thirty solid days of conferences provided for highway engineers between now and the middle of January. This is not too much time for studious consideration in conference of our multifarious highway problems but it is too much time to listen in convention to perfunctory papers and discussions. As this conviction grows among engineers it may be anticipated that more highway technical associations will do what a few in part are now doing—devote the bulk of the convention period to conferences in committee and give time in general convention only to action on committee reports and to association business.

When Employee Becomes Employer

IN ALL discussions over wages, the representatives of the labor unions have made it a practice to maintain that the ability of the employer to earn an income on his investment was outside of the discussion and of no importance to the employees or their representatives. In those days the funds of the labor unions were needed for the advancement of their cause and the time of their leaders was absorbed in such work. But of late the more powerful unions, such as that of the enginemen, have found their funds accumulating and have found that their officers have time to devote to the interests of the banking institutions which they have established. In this process of invest-

ing funds the enginemen acquired control of the Coal River Collieries which, they later found, could not be operated profitably under the scale of wages then in effect. The only way to reduce the cost of production was to induce the miners to accept lower wages. This, however, the miners refused to do, using the old union argument to the effect that the fact that the coal could not be sold at a profit was no concern of theirs. The manner in which the dispute will be settled is relatively unimportant; what is important is that the discussion cannot but have a sobering effect upon the representatives of the enginemen in their impending discussion of enginemen's wages on the western railroads. Now that they have publicly declared their right to earn an income upon the money which the enginemen have invested in a coal mine they can hardly deny the investors in railroad securities a similar right.

Bonus Payments Illegal

BONUS clauses in construction contracts are unenforceable in Kentucky according to a decision of the Court of Appeals of that state. This decision was handed down in passing on an appeal taken from a lower court decision on bonus and penalty payments in a suit arising from a contract for school buildings in Paducah. It is however the general reading of the law and not the specific case that is important. As stated the court's interpretation of law is that on public works contracts a bonus clause is illegal. The reasoning is simple: (1) Neither public nor quasi-public corporations may pay out public moneys or contract to pay them out without express authority of law; (2) The statutes authorize contracts and payments for construction but do not authorize the giving of a bonus or any gratuity to a contractor for speedy construction or completion before a specified time. Commenting on the law the court said: "The facts of this case strikingly illustrate the wisdom of the rule that public moneys are not to be paid out without express authority of law. If it was in the power of such a board in handling public moneys to contract for a bonus or gratuity of $100 a day, it also had the power to contract for a bonus of $1,000 or more a day. Manifestly, such authority would enable a corrupt or improvident board, by collusion with a thrifty contractor to quickly consume and dissipate educational funds." As a matter of fair play penalty charges as well as bonus payments should be prohibited in Kentucky, but the basis of law laid down in this decision does not seem to apply to penalties. However, a new suit to decide just this question has been brought and the law in the matter should soon be stated.

Road Corrugation Not Explained

WITH the publication of the full report of the Bureau of Public Roads upon its observations on gravel road corrugation, a tangible basis for discussion of this troublesome phenomenon is furnished. A short reference to Mr. Ladd's observations and conclusions was given two years ago by W. H. Root in a general discussion of gravel road maintenance (*Engineering News-Record*, Nov. 30, 1922, p. 943), but much essential detail was then omitted. The full report is therefore of great interest. Nevertheless it leaves the subject almost as far from clearness as before. It reports the fact that the length of corrugations is surprisingly uniform, ranging from 25 to 35 in. and averaging 31 in., which disposes of the rather common belief that road planers are the original cause of the corrugations. Planers could not produce an effect similar to chatter marks at such wide spacing and so regularly, under the widely different conditions of their operation. Moreover, corrugations occur out of all relation to dragging operations.

But the two alternative explanations which are substituted by Mr. Ladd can hardly be said to be satisfying. Corrugations in loose material, he asserts, start as the result of a wheel spinning action just beyond an obstacle in the road, and then travel forward, each corrugation serving as a new obstacle to promote the formation of a new depression ahead. Spring action of the vehicle is supposed to assist in this process. On surfaces having no loose material but exhibiting some compressibility or plasticity, on the other hand, corrugations form as the result of impact, somewhat as they do in bituminous pavements. If these explanations are correct, it would seem that corrugations should occur on all earth and gravel roads carrying more than the minimum traffic necessary to start their formation. As they do not occur on all such roads, the explanations given cannot be accepted without extensive reservations.

It would be valuable to know under what conditions corrugations do *not* occur; study in this direction might lead most directly to the discovery of means for preventing corrugations. On this latter question, Mr. Ladd's study has apparently not helped us along greatly. In short, while forming a most interesting and stimulative starting point, it appears more valuable as a suggestion for extensive additional research than as an answer to any of the major questions which the problem presents.

Assessment-for-Benefit Reform Needed

THAT the rain falls alike on the just and the unjust, or more literally upon all the land tributary to a given storm-water trunk sewer, was the accepted basis of raising funds to pay for such sewers at Kansas City, Mo., until Aug. 8. Accordingly, all real estate in a trunk sewer district was assessed at a uniform rate per square foot and apparently the city as a whole bore no share of the cost of sewers. On the date named, American fashion, the opposite extreme was adopted by a heavy majority which declared for raising the entire cost of three large trunk sewers by a bond issue that will be a charge against the entire city.

Whether past practice at Kansas City was supposed to accord with the assessment-for-benefit principle we do not know. If so, it was based on a misconception. The very term, assessment for benefit, assumes judicial action based on the facts of a given case. Instead of this, the Kansas City practice rested on the arbitrary prejudgment of the framers of the Missouri constitution which decided that a storm sewer benefited only the real estate in the tributary area and that the benefit was equal on each square foot of land within the district, no matter how located or used.

That Kansas City so long remained without choice as to whether the cost of trunk sewers should be met by districts or by the whole city, and should have tolerated

so crude a method of district assessment, is only less explainable than that such details of local administration should be embedded in a state constitution, to be rooted out only by a constitutional amendment. Apparently the amendment obtained recently in Missouri did not go far enough. Unfortunately, too, it appears that Kansas City is not yet free to choose between meeting the entire cost of a trunk sewer by bond issues and meeting it by an accredited assessment-for-benefit plan.

If it is assumed that due consideration has been given to the distribution of benefit between the city as a whole and the property in an assessment-for-benefit district and that the boundary of the district has been judicially determined, there still remains a question as to how the portion of the cost of the improvement can most equitably be spread over the land benefited. This question includes both the assessment unit—area, front foot or what not and possible combinations of these—but also varying degrees of benefit, according to use and location of property, etc., and the nature of the public improvement itself. In the Kansas City case in point the sole basis of the assessment was area, and the rate uniform.

If a uniform spread be warranted for any improvement perhaps a storm sewer would be an example par excellence, since within a storm sewer district the rate of rainfall is uniform; but even so every competent engineer knows that the runoff may vary materially from different portions of a storm-sewer district, especially taking the time the precipitation reaches the sewer into account—an important element in design and cost. The uses to which land is put must also be considered, as well as its location and topography, for it would be absurd to claim that gently sloping outlying agricultural land is as much benefited by a storm sewer as flat land in a business section. Moreover, there are few sewers that do not carry sewage as well as storm water, and there is less relation between land area and required sewer capacity in the case of sanitary than in that of storm sewers.

These and many other factors show how crude and arbitrary the Kansas City trunk sewer assessment plan was and add to the absurdity of embedding such requirements in a state constitution.

If the Kansas City case were without parallel or similitude there would be little reason for discussing it. Unfortunately, hundreds of other American cities are subject to assessment plans which at best are only less absurd and unjust. This is largely due to the fact that assessment practice rests far more upon legal precedents than engineering principles. It fails to take sufficiently into account uses, capacities and costs in relation to benefits resulting from public improvements. Moreover, when the legal precedents were being established, and the same is still largely true, the assessments were levied by commissioners with little knowledge of law and less of engineering, generally on the simplest rule-of-thumb plan of which the commissioners thought the law would permit. These commissioners had to work to statute or charter provisions, also based on legal precedents rather than engineering principles, and they generally took more legal than engineering advice in their interpretation and execution of the law. The result is what may be seen on every hand: Arbitrary charter, statutory and even constitutional methods of assessment prescribed, and where reasonable discretion is left to assessment commissioners, crude rule-of-thumb methods practiced with little regard for anything except the ease of the commissioners in traveling precedent-paved roads.

It is time for engineers to take a hand in bringing public improvement assessments into line with correct assessment-for-benefit fundamentals, and then to see that the practice is varied to suit the nature of various classes of public improvements, each on a capacity-cost-service-benefit basis.

For a New View of Traffic Control

NEW YORK CITY is in the throes of another change in traffic regulation. All east and west downtown streets are to be made one-way thoroughfares and certain of the north and south avenues are to be restricted as to travel. One more step has been taken in the continuing conflict of movement against space; the unalterable law that two things cannot occupy the same place at the same time is working. How long this make-shift theory of caring for traffic is to continue no one knows but one thing is sure, sooner or later its possibilities are going to be exhausted, not only in New York but in all our cities, and real constructive measures will have to be taken.

So far the lay view toward traffic congestion has prevailed. The policeman and the safety expert take conditions as they are and try to regulate and educate humanity to live under them safely, conveniently and comfortably. The engineer views traffic congestion as a fundamental problem to be solved by changing physical conditions so that human nature will not have to change any more rapidly than it normally can. The policeman puts up a sign and says go this way or go that way; the engineer would build a new street, or a round-a-bout road or a second story which is so obviously an easier way that traffic wants to take it. The safety expert warns people not to jay-walk; the engineer would put in an underground passage through which one may walk as he wills. The principles of their respective philosophies of attack are thus basically different.

Unfortunately so far the conformist theory of the traffic control officer has prevailed. We are trying to accommodate human nature to new physical facts and because these new physical conditions were at first only slightly changed from old ones the method was fairly successful. But the conditions are fast getting ahead of us. Conformity no longer is successful. Each day sees one more futile move to twist and turn the human factor—which will bear but little more turning. We must soon come to the change in the physical factor. The many ingenious plans for rearrangement of traffic-ways which have up to now for the most part been regarded as mere exercises of engineering mentality must be put into effect. The cost will be high but it will not be so high as the loss which must result from the continued retreat before the hordes of traffic that threaten to block our cities and even some of our countryside.

Engineers' plans for traffic relief are no longer to be regarded as fantastic dreams for the future; they are becoming the only solution which gives any promise whatever of solving the great problem of traffic.

Building a Hydro-Electric Plant on Saguenay River—I

Electrically-Driven Construction Equipment Used Entirely on Half-Million Horsepower Operation in Northern Quebec—Work Lasts Through Three Sub-Arctic Winters—Thirty-Mile Service Railway Used

A hydro-electric power development in two stations aggregating 1,200,000 hp. has been begun on the Saguenay River which drains Lake St. John in northern Quebec. In the present construction the power house will be completed for twelve 45,000-hp. units, but at first only eight of the turbine generator units will be installed. The operating head will range from 120 to 100 ft. In the second station the head will be twice as great.

The Saguenay power development is being carried out by the Quebec Development Co., Ltd., with J. B. Duke, president. The late Sir William Price was vice-president and chief owner with Mr. Duke. W. S. Lee is vice-president and chief engineer; and F. B. Cothran is vice-president in charge of construction.

There will be three articles on the construction operations, of which this is the first.—EDITOR.

I. Developing Access and Habitation

CONSTRUCTION on the first of two hydro-electric plants planned to develop the water power of the Saguenay River in Quebec has reached a stage where completion in August, 1925, is predicated with assurance. The first cofferdam was begun in January, 1923. In this period of 31 months construction comprises the major operations of (1) placing half a million cubic yards of concrete in seven spillways and a power house

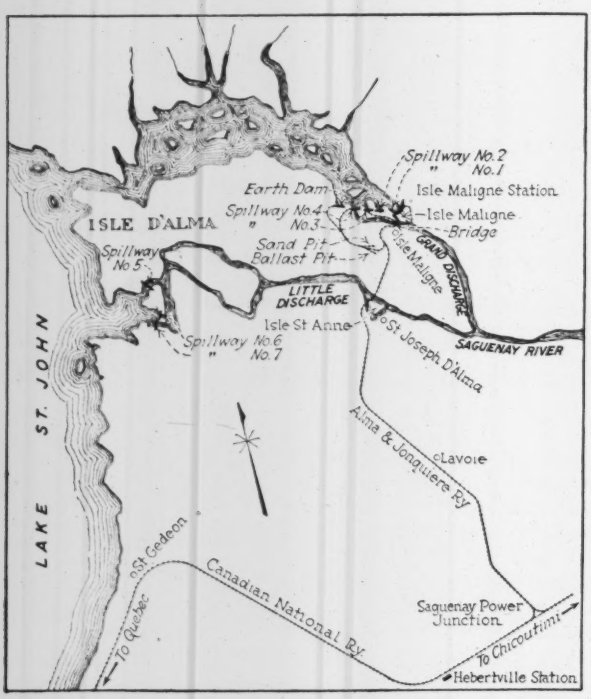


FIG. 1—GENERAL LOCATION OF ISLE MALIGNE STATION, SAGUENAY POWER DEVELOPMENT

having twelve 45,000-hp. turbine emplacements, (2) erecting a brick and steel power house superstructure and installing eight turbines with their 30,000-kva. generators, (3) moving some 325,000 cu.yd. of earth and rock in foundation emplacements and the tailrace, (4) building a hydraulic-fill dam 600 ft. long and 45 ft. high, (5) developing sand pits and quarries for ballast and concrete, (6) building eleven miles of permanent railway and 14 miles of standard-gage service railway, (7) providing a camp for housing and feeding a thousand workmen and (8) installing and removing a construction plant costing upward of a million dollars. This volume of construction is made possible only by a well planned attack to overcome considerable difficulties.

Nature and the location had set up many obstacles. The site of the plant on the upper reaches of the Saguenay River is 150 miles north of the city of Quebec. Here the winters are severe and of long duration. The stream itself is a deep and tumultuous rapids at high water and is swift-flowing at all times. A straight line from the power house to the farthest of the row of nine dams was some six miles long. The location of the main volume of work was in a rocky gorge on an island which separated the stream into two channels. There were no adequate means of access, no stream crossings and no place for working forces to live. High water came in June and subsided very gradually to low water in March.

These conditions not only introduced construction difficulties but they made necessary a large undertaking to prepare for actual operations on the permanent structures. The development of the attack was therefore the first phase of the construction task. It combined (1) providing access and habitation and (2) installing plant and operating power. These operations are virtually finished. The second phase was construction proper, which is now actively in progress with a good start on the main items.

Structures and Quantities—The map, Fig. 1, indicates the geography of the territory and the location of the permanent structures. The main unit is a power house of the headwall type 722 ft. long and of the cross-section shown by Fig. 2. The other units are seven concrete spillways and an earth dam. The group of profiles, Fig. 3, gives the longitudinal dimensions and indicates the foundation conditions of the spillways. They all have ogee faces and vertical backs and carry piers for gate emplacements. The earth dam is 20 ft. wide and 600 ft. long on top and is 45 ft. high with slopes of 1 on 3 and 1 on 2½. The 11-mile railway is permanent construction and there will be minor structures for plant operation and current distribution.

As the illustrations indicate, the main construction tasks are concrete work and excavation largely in rock. The volumes in round numbers are: Power house and spillway 1, concrete 300,000 cu.yd., and excavation 280,000 cu.yd., including tailrace; spillway 4, concrete 150,000 cu.yd., and excavation 25,000 cu.yd.; spillway 3,

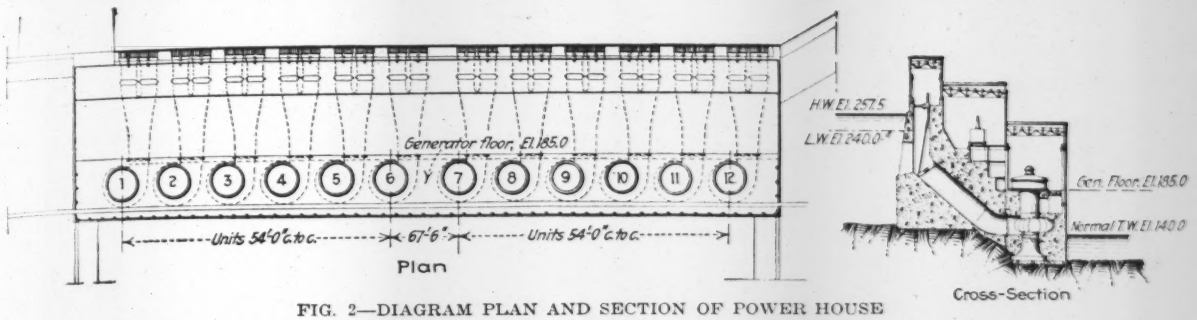


FIG. 2—DIAGRAM PLAN AND SECTION OF POWER HOUSE

concrete 21,000 cu.yd. and excavation 8,000 cu.yd.; spillway 2, concrete 2,000 cu.yd., and spillways 5, 6, and 7, about 27,000 cu.yd. Considering the mixing plant as the center, spillway 1 and the power house are 1,000 ft. away, spillway 2 is 2,500 ft., spillway 3 is 4,000 ft., and spillway 4, which is approached at both ends, is 2 miles away on Isle Maligne and 2.7 miles on Alma Island. These distances are all service railway measurements and not bee-line distances. Spillways 5, 6, 7, by similar measurement, are upward of 8 miles from the mixing plants.

Volume of structures, even with their scattered location, is pretty well concentrated on Isle Maligne. The topography of this territory is to be observed. This is indicated by the contours of Fig. 4, and is very rough. Briefly, the Grand Discharge of the Saguenay north of Alma Island is a deep rocky gorge in which Isle Maligne, itself rugged and precipitous, separates the stream into two channels. A comparison of the elevations, Figs. 2, 3, and 4, makes the situation entirely clear. With the volumes, distances and elevations as described the initial tasks were to develop access and provide habitation.

These were planned with virtually the same care as were permanent structures and the plans were fully laid down before any construction was begun. In brief, when the preliminary working forces went into the field they knew what railway, including terminals and yards, was to be built and what camp structures were to be put up and where. No opportunity for false moves and waste motion was permitted so far as advance planning could prevent. Climate and stream flow set the times when certain construction operations could be begun and must be finished. Chance of delay due to poor plans in getting ready was not to be risked.

Development of Access—The isolation of the operation is indicated by Fig. 1. The nearest railway was the line to Chicoutimi of the Canadian National. A highway of fairly good order, but with heavy grades, led from Hebertville to St. Joseph D'Alma, crossed the Little Discharge and swung north and east and crossed the Grand Discharge some distance below Isle Maligne. St. Joseph D'Alma is a small village chiefly of interest in the present connection as the location of a paper mill to be built by the Price interests. Other settlement is widely scattered. Isle Maligne was virtually inaccessible.

Access from the outside was the first consideration. Beyond getting in the employees and doing some sledge haulage of materials and supplies for the preliminary work of the first winter, all conditions put the highway out of consideration. A railway provided a short haul, reasonable grades, unbroken shipments, load capacity, volume of traffic and means of handling the snow, none of which could be got by any practicable road. Moreover a railway was an integral parcel of a complete power development, gave a shipping outlet to any further industrial development such as the planned paper mills at St. Joseph D'Alma and, extended by service tracks to the spillways and other parts of the work, it completed a positive construction function. A fairly direct location, as shown by Fig. 1, was found. From the junction to the power house by this location was 11 miles, with reasonably easy grades. The track is ballasted and laid with 70-lb. rail. All bridges are steel on concrete piers, the longest being that to Isle

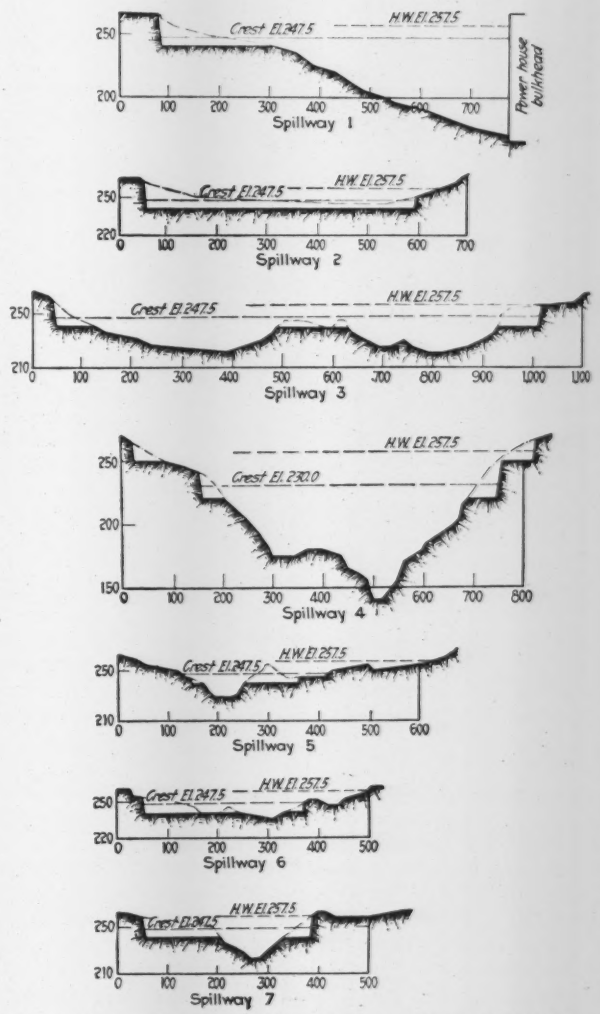


FIG. 3—PROFILES OF SEVEN CONCRETE SPILLWAYS

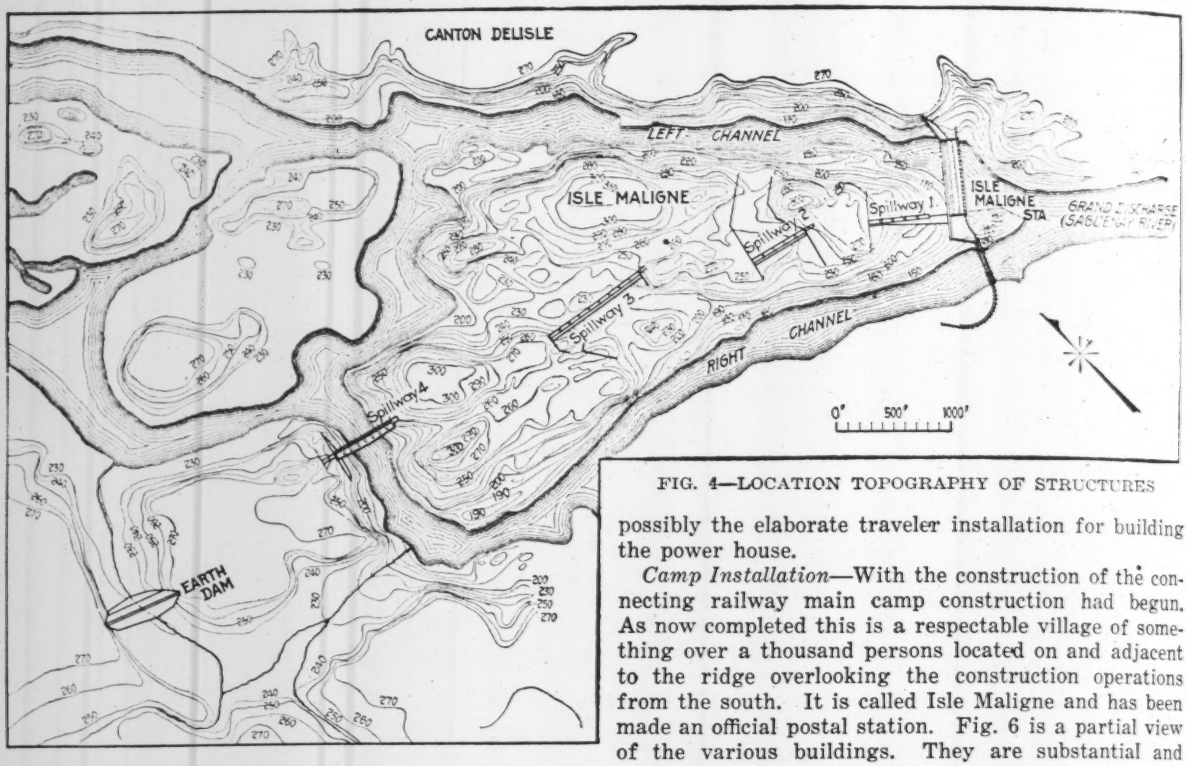


FIG. 4—LOCATION TOPOGRAPHY OF STRUCTURES

Maligne, as described in *Engineering News-Record*, July 17, 1924, p. 94. The terminal arrangement at the operation is shown by Fig. 5.

The yard tracks and service lines add about 14 miles to the railway system. They are shown by Figs. 4 and 5. Every major structure, except the three small spillways at the head of the Little Discharge, is reached by a service railway. These lines naturally are of less permanent construction than the connection to the Canadian National but 70-lb. rails are used and they are surfaced and have grades which make speed possible by the heavy trains carrying mixed concrete. These service railways have been laid down in part during 1924 as need for them has developed, but the permanent branch was put through in 1923.

Railway rolling stock and power is limited to locomotives and cars employed in construction. Shipments from the outside come in by the equipment of the regular carriers. The construction locomotives are 33 and 40-ton saddle tanks with 14,400 lb. and 17,400 lb., tractive power respectively. There are 18 in operation. There are 20 flat cars of 80,000 and 100,000 lb. capacity; they are standard manufacture except a few built for especial durability in the shops of Isle Maligne. The dump cars are: 36 air-dump 20-cu.yd. cars and 20 hand-dump 6-cu.yd. cars. Engine and car maintenance are handled in the job machine and blacksmith shops.

With the combination of connecting railway and service lines, materials, supplies, machinery and structural units of any size capable of railway shipment can be laid down, directly from the cars, in yards or storage places or at the structure where they are to be used. Indeed railway service to all structures and construction plant units is made so complete that job haulage by any other means is virtually eliminated. This is an outstanding feature of the construction plan which exceeds in importance perhaps any other except possibly the elaborate traveler installation for building the power house.

Camp Installation—With the construction of the connecting railway main camp construction had begun. As now completed this is a respectable village of something over a thousand persons located on and adjacent to the ridge overlooking the construction operations from the south. It is called Isle Maligne and has been made an official postal station. Fig. 6 is a partial view of the various buildings. They are substantial and neatly built structures without any straining after polish or paint, but with attention to hygiene and comfort. They have sewerage and water supply, are lighted and furnished with stoves.

Particular attention is given to water supply.

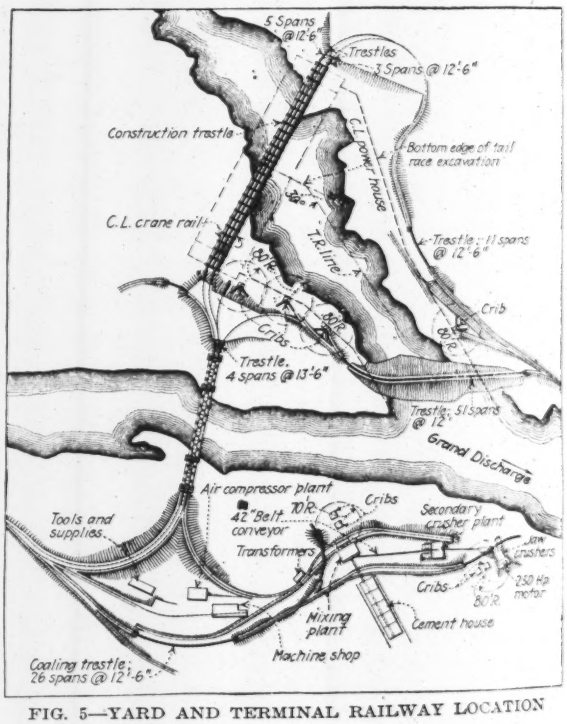


FIG. 5—YARD AND TERMINAL RAILWAY LOCATION

Water from the river is pumped to a 20,000-gal. tank on a hill above the camp, and thence distributed over

the camp and works. The distribution was rather expensive because of the cold climate. All pipes had to be placed at least 6 ft. under ground to prevent freezing and much of the trenching was in rock. Chlorination was also employed. While the large volume of flow made the danger from pollution rather remote it was felt necessary to guard as fully as possible against typhoid and so a chlorination plant was installed.

Without proceeding to extremes the camp was made self-contained. At best the community is isolated, particularly in winter, and there must be within itself the means of community life. So a store and post office and hospital are provided besides the usual dining halls, bunk houses and cottages. There is a resident physician. One of the common rooms provides means for a school. For none of the plain necessities of life need one leave camp. Indeed he can bank his money there if he wishes. Primarily, however, the idea is kept in mind that the camp is a utilitarian institution, a means of housing and feeding a thousand workmen, and bunk houses and dining hall are given preferential attention.

Only a very general chronology of the railway work and camp building is practicable. Railway construction arrived at Isle Maligne in August, 1923, and then followed camp building in its major part, simultaneously with plant installation and bringing in power for plant operation.

[*Installing plant and power for plant operation followed immediately the work of providing access and habitation and is described in a second article in the issue of next week. Few construction plants have been so thoroughly planned and co-ordinated.*—EDITOR.]

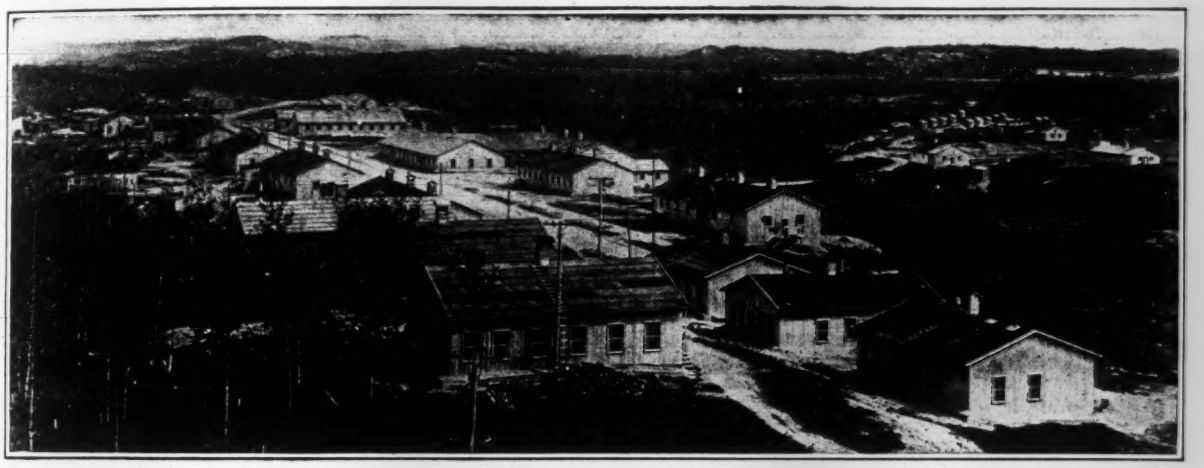


FIG. 6—MAIN STREET OF ISLE MALIGNE, THE CONSTRUCTION CAMP

Painting Signs on Pavement Illegal

The California Highway Commission has issued instructions to all division officers throughout the state to the effect that the painting of signs on state pavement is illegal and directing that all signs other than those placed for the direction of traffic be forthwith removed. The order is the result of complaint concerning the painting of the letters "KKK" on state highways, particularly in southern California, followed by an investigation of the law on this point by Paul F. Fratessa, attorney for the commission. Mr. Fratessa finds that the unauthorized painting of signs on state pavement is a misdemeanor under state law.

Rapid Transit Proposed on the Thames

London Correspondence

SIR SAMUEL INSTONE, who has done much to encourage civil aviation in Britain, proposes to organize a passenger service of fast motor-boats on the Thames. It is proposed to inaugurate the service with a fleet of 25 luxurious twin-screw motor-boats, each with a passenger capacity of 300. An all day service, at intervals of 15 minutes, would be run from Hammersmith, which is the center of the western residential district, to Greenwich, which is a populous district on the south-east side of London. Another service would be run from Hammersmith to Woolwich, which is further east than Greenwich. This service is to be at intervals of 45 minutes. Express boats would run every few minutes during the rush hours for business traffic.

The fare on any of the trips, it is suggested, shall not exceed 1d. per mile, and it is estimated that at least 12 million passengers would be carried per annum, though Sir Samuel Instone has calculated that one-third of that number would suffice for the success of the undertaking. In arriving at such an estimate the company is not relying on taking away from the traffic combine the large numbers of people who live close to a subway station, though they point out quite rightly that there are several populous districts fringing the river which are not served by rail, or where, if a trip from due west to a point on the east side has to be undertaken, travelers have to make one or more changes either on the buses or the subway system. As compared with trams and buses it is claimed that the motor-boats would be quicker and cheaper for a journey of two miles and more. Owing to the acute traffic congestion in the streets a journey of four miles by bus or tram into the city often takes from 40 to 50 minutes; motor-boat service would take 30 minutes.

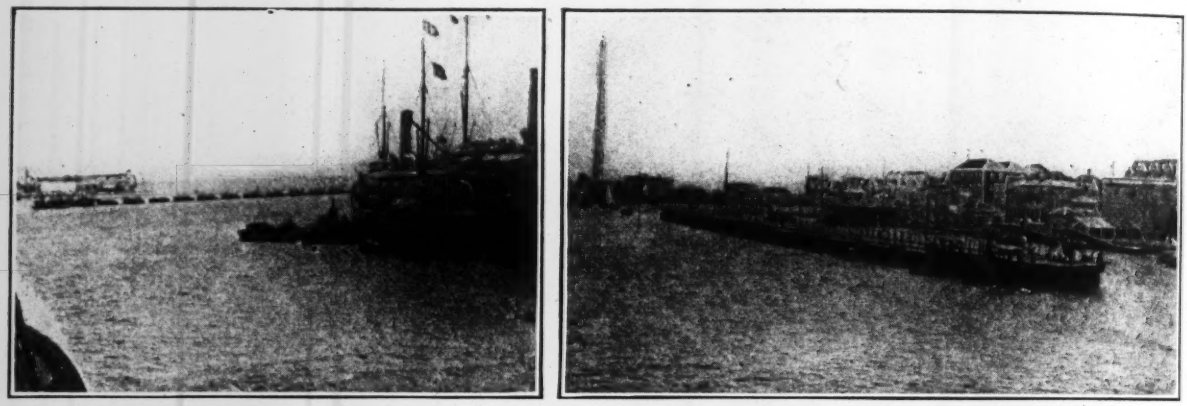
The president of the Institute of Transport, referring to the scheme and the possibilities of the Thames as a highway, says: "In the Thames we have miles of highway broader than the broadest street in the world; existing traffic negligible; no cross traffic and therefore no need for regulation; a smooth surface which never requires repair or renewal; no scavenging or drainage required; no unco-ordinated authorities who could tear up the surface and obstruct traffic for weeks together."

Pontoon Swing Bridge at Curacao in the Dutch West Indies

By Baird Snyder
Westfield, N. J.

A PONTOON swing bridge, operated by a winch driven by a donkey initial engine, serves as the single means of intercommunication between the two halves of Curacao, Dutch West Indies. The bridge carries across the one narrow entrance to the harbor of this refuelling and transshipping station in the Caribbean both pedestrian and vehicular traffic from one-half of the busy little town to the other. As a free port, trading station, and refuelling port, the town depends for its economic life upon the shipping entering its harbor. Any deterrent to traffic in the channel would threaten the commercial existence of both port and the island.

To connect these two parts of the city a high bridge was found impossible because of the low-lying banks of the channel and the slight elevation of the greater part of the town above sea level. Any of the usual draw spans necessitating piers in the channel were not feasible, as soundings previously taken to determine the practicability of a subaqueous tunnel, so it is said, revealed an unsounded depth of semi-coral, semi-volcanic formation. The difficulties have therefore been overcome by the installation of bridge herein pictured.



WINCH-SWING PONTOON BRIDGE AT CURACAO, DUTCH WEST INDIES, IN CLOSED AND OPEN POSITION

The draw span of this pontoon winch-swing bridge is an integral pontoon structure hinged at one end to a fixed pontoon section, attached to the shore at its approach end and anchored at the other. On the free end of the draw span in the end pontoon is a donkey engine and a winch. The winch is equipped to wind either of two cables, one of which is attached by a ring bolt in the heavy retaining wall near the hinged end of the swing structure, the other being similarly tied to the other side of the channel. When the draw is to be opened, the winch winds up the cable attached near the hinge and the bridge goes to sea. When the moving portion of the structure lies parallel to the short line the cable attached to the other bank is paid out until there is draft enough over it for the ship to pass out or in. Closing is effected by taking up on this cable and swinging the bridge.

An interesting traffic feature of this bridge is the fact that pedestrians wearing shoes are required to pay two Dutch cents toll to cross it, while barefooted ones pay one-half that sum. The honesty of the native populace appears so well established that one seldom sees any of the two-centers surreptitiously slipping off his footwear.

The Foreign Labor Question in France

Paris Correspondence

FRANCE is in the throes of a foreign problem. Within recent months considerable numbers of unskilled laborers have entered or have been imported into the country. They came to work in the mining, metallurgical and construction industries, which demand more laborers than France possesses—there is no unemployment in France. These foreign laborers are not only unskilled but many of them have proved to be undesirable. Much of the crime of Paris and the large industrial centers is committed by this foreign element.

There are two sides to the question. On the one side are the owners of the mines or metal industries or contractors in the building trades, who need the labor; in fact, many an industry is running at part capacity for lack of it. It is said that forty thousand Poles were imported to work in the coal mines in the northern departments within the last three months. On the other side there is fear among French workers that sooner or later cheap labor from abroad will tend to reduce wages for the French laborer.

The national committee of the General Federation of Labor at its annual meeting recently presented a resolution to the Minister of Labor and Public Works to the effect that there are far too many foreigners employed in the mines, metallurgical industries and building trades.

The whole question resolves itself into whether this influx of foreign labor will influence the wages of the French laborer. A clause in the working contract that would prevent the employer from employing any labor below the standard accepted scale of wage would appease the French laborer, who feels that so far as his numbers will accomplish mining and construction work the money for it should go into his pocket. France needs to increase her output in all lines, which she might readily do with the equipment she possesses.

As to the question of immigration, on Sept. 19 Signor Mussolini and the French ambassador at Rome signed an important agreement regulating the entry of Italian workmen in France which concerns their right to workmen's accident indemnity and old age pensions provided they remain in the country.

New Iowa Tests of Truck Impact on Highway Bridges

Measurements During 1923 Under One and Two Trucks of 14 Tons Weight Indicate High Percentages of Impact

RESULTS of the second season's work in impact tests on highway bridges at Iowa State College have just been published in the September issue of *Public Roads* (monthly publication of the U. S. Bureau of Public Roads). The test work is conducted as a co-operative undertaking of the Bureau, the Iowa State Highway Commission, and the Engineering Experiment Station of Iowa State College, and is directed by Prof. A. H. Fuller, of the college. Very high impacts were found, especially when the motor trucks used as loading were run over blocks 1 in. and 2 in. high placed on the bridge floor. The work entirely confirms the results of the preliminary experiments made in the first season's work (1922), noted in *Engineering News-Record* of Jan. 25, 1923, p. 167, and fully reported in Bulletin 63 of the Iowa Engineering Experiment Station.

Test Bridges and Loads—Most of the 1923 work was done on a 150-ft. truss bridge and a 32-ft. truss bridge forming the main and approach spans of the Lincoln Highway bridge over Skunk River near Ames. A few tests were made on a 70-ft. plate girder (Squaw Creek bridge) at Ames and a 40-ft. pony-truss bridge at Roland, Iowa. All three bridges have 8-in. concrete slab floors. In each case both static load and impact stresses were measured and the impact was determined both for floor clear of obstructions and for the condition in which the trucks ran over 1x2-in. and 2x4-in. obstructions placed on the floor. The loads were 3½-ton trucks fitted with solid rubber tires and loaded with gravel to a total weight of about 14 tons. Some tests were made under one truck, others under two trucks abreast. "Static stress" measurements were made when the trucks ran at a very slow speed; impact measurements were made at full speed, 10 to 14 miles per hour.

Stringer Stresses—Extensometer readings taken at various points along the vertical section of a floor stringer showed the neutral axis to be considerably above the middle line of the web in all cases. Both the amount of the flange stress and the position of the neutral axis in a number of the measurements agreed very closely with the values computed for T-beam action of the concrete slab and the steel stringers. Generally, however, the stresses were sufficiently lower than those computed on this basis to indicate some end restraint of the stringers. In some cases the neutral axis was sufficiently below its computed position for T-beam action to indicate that the bond between stringer and slab had broken.

Impact Stresses—A summary of the impact measurements is given in the table herewith. In each case the first column, giving a stress figure in pounds per square inch, indicates the total stress including impact, while the next column gives the impact-stress percentage (slow-speed or static stress taken as 100). For each item in the list, two sets of values are given; the upper line is an average of the two high results in each group of runs, while the lower line gives a general average. In compiling the figures, greater weight was given to runs made under the more satisfactory and more nearly typical conditions.

The report from which we quote further summarizes this table by the following statement:

Probable percentages to be added to static load stresses to allow for impact are:

For stringers: Clean floor, 12 per cent; 1-in. obstruction, 40 per cent; 2-in. obstruction, 80 per cent.

For floorbeams: Clean floor, 10 per cent; 1-in. obstruction, 40 per cent; 2-in. obstruction 57 per cent.

For hip verticals: Clean floor, 25 per cent; 1-in. obstruction, 90 per cent; 2-in. obstruction 150 per cent.

Similar percentages for main truss members (see table) are omitted from the summary, says the report, not because the results do not command confidence, but because they are few in number and because the unit stresses are so small that they are not representative of fully loaded structures.

Observed and Computed Stresses—For all members and load positions at which stresses were measured, cal-

SUMMARY OF IMPACT PERCENTAGES AND IMPACT UNIT STRESSES, SKUNK RIVER, SQUAW CREEK, AND ROLAND BRIDGES

(Truck speed 10–14 miles per hour)

Member	14-ton truck: No obstruction Stress Lb.	Per cent	1 by 2-in. obstruction Stress Lb.	Per cent	2 by 4-in. obstruction Stress Lb.	Per cent
Stringers, approach span, Skunk River bridge	4,400	22	5,400	43	9,300	140
	4,100	16	4,700	32	8,000	120
Stringers, main span, Skunk River bridge	11,000	35	12,200	57	15,000	95
	10,000	20	11,200	40	13,400	70
Top chords and end post, Roland bridge	4,500	40	7,000	100	13,000	350
	4,000	25	6,000	70	9,800	180
Lower chords, Roland bridge	2,900	43	3,600	70	4,300	110
	2,600	30	2,900	43	3,900	78
First diagonals, Skunk River bridge	2,500	60	4,600	150	9,000	350
	2,300	40	4,000	120	7,500	250
Hip verticals, Skunk River bridge	[2] 4,100	[2] 17	[2] 7,500	87	[2] 11,500	175
	[3] 2,000	22	[3] 4,000	137	[3] 6,700	275

Member	Two 14-ton trucks: No obstruction Stress Lb.	Per cent	1 by 2 in. obstruction Stress Lb.	Per cent	2 by 4 in. obstruction Stress Lb.	Per cent
Stringers, approach, span, Skunk River bridge	5,800	17	7,400	40	10,500	100
	5,600	12	6,700	32	8,800	75
Stringers, main span, Skunk River bridge	10,600	17	14,000	43	16,000	85
	10,000	10	12,000	34	14,500	67
Stringers, Squaw Creek bridge	6,700	21	10,400	95	15,000	180
	6,100	14	9,800	82	13,000	120
Floorbeam, Skunk River bridge	8,300	10	10,500	50	11,500	68
	7,800	10	9,500	45	10,200	55
Floorbeam, Squaw Creek bridge	5,000	15	6,500	50	9,000	92
	4,500	10	6,000	40	7,500	77
Floorbeam, Roland bridge	6,700	17	8,000	45	14,000	150
	6,400	10	7,500	30	12,000	100
Top chords and end post, Roland bridge	5,900	29	7,400	50	10,000	115
	5,300	20	6,700	35	8,800	78
End post, Skunk River bridge	1,200	45	.....	....	2,000	80
	1,000	30	.....	....	1,500	30
End post, Skunk River bridge[1]	1,500	45	.....	....	2,200	45
	1,200	30	.....	....	2,000	30
Lower chords, Roland bridge	3,400	28	3,900	50	6,000	130
	2,900	20	3,400	33	4,500	67
North girder, west span, Squaw Creek bridge	3,000	25	3,200	30	4,500	65
	2,800	20	3,000	25	4,000	50
Same[1]	3,000	30	3,300	35	5,000	80
	2,800	25	3,000	30	4,500	60
First diagonals, Skunk River bridge	3,500	70	.....	....	7,500	200
	3,000	50	.....	....	7,000	150
Same[1]	3,350	38	6,600	140	7,000	140
	3,000	30	4,900	75	6,000	100
First diagonals, Roland bridge	7,300	48	9,700	73	12,000	140
	6,800	30	7,000	40	10,000	100
Remaining diagonals, Skunk River bridge	4,200	25	4,600	40	6,800	100
	3,800	20	4,100	30	5,800	72
Remaining diagonals, Roland bridge	2,500	58	3,400	100	4,600	185
	2,100	35	2,800	60	3,500	110
	−4,000	−75	−4,200	−91	−5,000	−125
	−3,200	−33	−3,600	−60	−4,300	−75
Hip verticals, Skunk River bridge	[2] 6,200	30	[2] 11,000	105	[2] 13,000	150
	[3] 2,400	23	[3] 3,800	85	[3] 4,800	112
Hip verticals, Roland bridge	[2] 4,100	20	[2] 5,200	40	[2] 8,500	130
	[3] 1,700	30	[3] 2,600	100	[3] 5,000	300
Post U2′–L2′, Skunk River bridge	[2] 2,200	50	[2] 3,600	45	[2] 10,500	200
	[3] 1,500	25	[3] 1,500	30	[3] 2,200	100
	[2] −2,000	−25	[2] −2,100	−45	[2] −4,000	−150
	[3] −1,800	−15	[3] −1,900	−30	−3,500	−100

[1] Two trucks in tandem, all others abreast.
[2] Average stresses in inside flanges.
[3] Average stresses in outside flanges.
Minus signs indicate reverse stresses in members.
Upper figures are the averages of the two high stresses in each group of runs. Lower figures are the general averages.

culations of theoretical stresses were also made. There were many differences between the observed and the computed stresses, the latter generally being larger. Bottom-chord stresses as measured were considerably lower than the computed stresses (for example, 2,720 observed, 5,600 computed; 1,810 observed, 3,990 computed), indicating that the floor system shared in carrying the bottom chord tension.

Plotting the results of endurance tests on a base of temperature, it was found that both the endurance range and the maximum stress in repetitive endurance tests remain almost constant with increasing temperature, at least to a temperature between 300 and 400 deg. C., then decreasing gradually according to a parabolic law. The static strength, however, decreases markedly above 300 deg. C., and there is decided lack of parallelism between the curves of variation of static strength and endurance strength with temperature. The ratio of endurance to ultimate strength, which at normal temperatures is equal to one-half, is therefore not constant. The value of the endurance range for a given mean stress decreases with increase of temperature, becoming zero at the temperature for which the mean stress is equal to the static ultimate strength at that temperature.

At the same meeting Prof. C. F. Jenkin gave a general review of fatigue work carried out for the Aeronautical Research Committee of Great Britain. Observations made by Gough at the National Physical Laboratory on the proportional limit of rotating endurance test pieces indicated that this limit agreed closely with the long-run endurance limit. Gough, Haigh and Griffith measured the rate of heat evolution of endurance test pieces, to determine whether the rapid rise of temperature due to hysteresis was an index of the endurance limit. In some metals (nickel, hard steel) they found several points of rapid heat evolution, none of which was related to the endurance limit, while in others (Armco iron) they found a steady increase of heat evolution, and no sudden increase. Heat generation was concluded to be no index of fatigue limit. Mason measured the rate of work input into the endurance test piece, by measuring the sidewise component of the deflection of the rotating piece; he found no sudden change in work input at the endurance limit. Lea found that when the proportional limit was raised by applying stress to a piece of metal, the endurance limit was raised also. The same fact was noted by Gough. It was also found that the application of repeated or alternating stress hardened the material.

Thomas studied the weakening effect of scratches, using very ingenious and refined methods to determine the depth and shape of the scratches. The sharpest scratch did not reduce the endurance strength by more than 30 per cent, decidedly less than had been expected. Correspondingly, tests at the National Physical Laboratory showed that the influence of keyways on the endurance strength of shafts is not as great as theoretical calculations of stress concentration would suggest.

Much work has been done on attempts to explain fatigue failure. Jenkin brought out the theory that slip within the crystal grains composing the test piece brought about the endurance yield and final fracture. Experiments by others showed this theory to be untenable, however. Griffith found that the endurance limit of Armco iron is above the yield-point. Gough and Hansen showed that slipbands result from motion in one direction only, rather than by motion in opposite direction as would result from alternating stress. The influence of viscosity of the material appears to be pronounced. Hopkinson suggested that endurance strength can be raised to near the ultimate strength of the material by making the alternations of stress very rapid. Jenkin has made endurance tests at speeds up to 120,000 alternations per minute, and has found the endurance limit to be increased by high speed. Viscosity, therefore, is most probably a factor in the phenomena of endurance resistance.

Experiments are being made on the endurance strength of vitreous silica (Griffith) and upon sealing wax and Bakelite (Jenkin).

Government in 1923 Spent $91.00 Per Head

GOVERNMENTAL expenditures in 1923 were $10,045 millions or 15 per cent of the total national income of that year, according to a study of public disbursements in connection with a survey of the tax burdens of 1923 made by the National Industrial Conference Board. This represents $91.00 from every man, woman and child in the United States last year and only 77 per cent of this expenditure is covered by receipts from taxation. Governmental expenditure in 1923 was more than 3½ times greater per head of the population than in 1902 and more than 5½ times greater than in 1890. Similarly 88 per cent of expenditures was covered by taxation in 1902 and 102 per cent in 1890.

Of the total for the calendar year 1923, $3,459 millions represents the amount spent by the federal government. In arriving at this figure, only the net deficit of the postal service was taken. Interest and amortization of the federal debt amounted to $1,526 millions. The state governments spent $1,450 millions and local governments disbursed $5,136 millions.

The volume of taxation raised annually does not afford an accurate index of total expenditures. Large amounts are collected from fines and penalties, special assessments for outlays for which they are later reimbursed, fees for special services rendered and revenues derived from commercial and industrial enterprises such as water-works, electric light and power systems, public markets and the like. In addition public authorities have the right to borrow funds on their own credit. In 1923 the sale of bonds by state and local governments aggregated $1,063 millions against $1,101 millions in 1922. In the first seven months of this year, long term borrowing by state and local governments has aggregated $1,036 millions as compared with $746 millions in the same period of 1923.

Hartford Plans for Financing Water Mains,

About two-thirds of the cost of water main extensions at Hartford, Conn., are assessed against abutting property and the remainder paid for out of water revenues. For preliminary financing about $100,000 worth of water bonds are issued yearly. These bonds are amortized in ten years. The amounts collected in the way of assessments are placed in a revolving fund which it is expected will within a few years be of such amount as to make further bond issues unnecessary. C. M. Saville is manager and chief engineer of the Hartford Water Board.

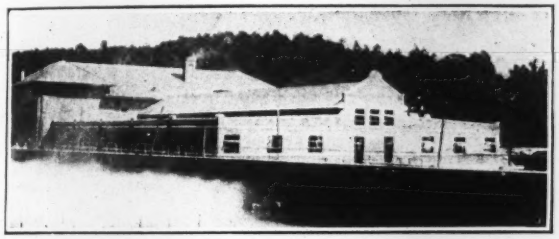
Features of New Water Filtration Plant at Richmond, Va.

Plant Built in Old Coagulating Basins Provides for Mixing and Coagulation, Mechanical Filtration and Aeration

By Wellington Donaldson
Chemist with Fuller & McClintock, Consulting Engineers, New York City

THE NEW water filtration plant of 30 m.g.d. capacity for Richmond, Va., was put into service on Aug. 29, handling a current demand of about 22 m.g.d. Construction work was started on May 12, 1922. The plant is of the mechanical filtration type, with mixing chambers, coagulating basins, etc., and with provision for aeration in the clear water basins when needed.

Ever since Richmond had a public water supply the James River has been the source. Beginning in January, 1910, treatment of the water has been by plain sedimentation in two artificial basins of about 85 m.g. capacity each and one mile in length, followed by coagulation with alum in two unbaffled basins of 15 m.g. capacity each. The coagulating basins have been operated alternately on the draw-and-fill plan and are believed to be the largest of the kind in this country.

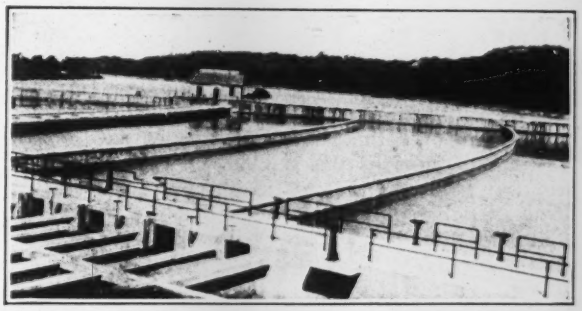


REAR VIEW OF RICHMOND FILTER BUILDINGS; AERATORS IN CLEAR WATER BASIN IN FOREGROUND

In the past two years of construction work, the fill-and-draw plan has been supplanted by continuous coagulation in one of the large sedimentation basins, alum being applied at a temporary treatment plant at the headworks.

The James River is badly polluted at its headwaters by sulphite waste from paper pulp manufacture. This waste, even after a travel of two hundred miles in a rugged stream bed, gives a high color to the water, results in unpleasant odor and taste at times, and calls for unusually heavy treatment with alum and chlorine. These characteristics of the raw water have influenced the design of the coagulating and aeration features.

Major Features—The new works are constructed inside the two old coagulating basins, making use as far as possible of the old walls and floors. They comprise the following major features: (a) Baffled mixing chambers of "around-the-end" type, with 10 minutes retention. (b) Four coagulating basins, each with a single "around-the-end" baffle. The basins may be operated singly or in parallel to give a retention of 3, 6, 9 or 12 hours. (c) Rapid sand filters consisting of ten units of 1,078 sq.ft. area each, equipped with rate controllers, hydraulic valves and suitable gages. (d) Retention basin and pump for handling waste filter-wash-water during exceptionally high stages of the river. (e) Clear water storage. Besides a small clear well under the filters the filtered water is stored in the open in that portion of the two old coagulating basins not occupied by the new plant. This gives a capacity of 3.0 to 7.5 m.g., dependent upon the method and rate of operation. (f) Pumps. In ordinary operation the entire flow through the plant is by gravity. To care for heavy future demands or when aerating, pumps are provided for handling the filtered water to storage. There are two 20-m.g.d. and two 10-m.g.d. motor-driven



RICHMOND MIXING CHAMBERS AND COAGULATING BASINS; OLD SEDIMENTATION BASINS IN REAR

units, the motors being designed for two speeds. (g) Aeration. For occasional use in combating taste and odors, there has been provided in the open clear water basin a bank of 300 brass spray nozzles arranged so that certain portions of the bank may be turned off or on by hydraulically controlled valves. (h) Coagulant devices. There are six dry-feed machines for feeding pulverized alum, hydrated lime, or soda.

Special Details—The plant is well metered throughout, there being a Venturi on the raw-water inlet and another on the filtered water lines leading to the clear storage. There is also a Venturi meter on the outlet of the wash-water tank with an extension dial visible from all parts of the filter room to show the rate of washing. There are laboratories in the head house.

The total contract price was $631,273. The work was divided as follows: Substructure, Whiting & Turner, $337,415; superstructure, Harrison Construction Co., $100,208; filter equipment, Roberts Filter Co., $193,650. Design and supervision of construction was in charge of Fuller & McClintock, New York City.

Irish Mono-Railway to Be Abandoned

The so-called Mono-Railway between Ballybunion and Listowell in Ireland is to be demolished according to *The Engineer*, London. It was built about 1888, is 10 miles long, and was constructed on the Lartigue monorail system. In commenting on the railway, *The Engineer* says, "That system, like nearly all its predecessors and successors, requires in fact three rails, one to carry the coaches on the top of trestles and one at each side to prevent them from swinging. Three little locomotives were built for the railway. They weighed about 6½ tons apiece, and each had two locomotive type boilers, one on each side of the carrying rail. The passenger rolling stock consisted originally of three first-class and four third-class coaches about 16 ft. long and 8 ft. wide. From the first the railway was far from a success, and the dreams of high speed were never realized. It ran with a happy disregard for punctuality and with a bumpiness and noisiness that excited the risibility of visitors, but somehow or other—probably, as its countrymen would say, 'by the will of God'—it has kept on puffing on its rickety course for thirty-six years. We trust that some part of it with an engine and rolling stock may be preserved."

Trickling Filter Distributors at British Sewage-Works

Notes Taken Recently at Sewage-Works of Birmingham, Bradford and Leeds Show That Traveling Distributors Rather than Fixed Nozzles Are Main Reliance

By T. Chalkley Hatton
Chief Engineer Sewerage Commission, Milwaukee, Wis.

With few exceptions American practice in designing trickling filters has not followed the English. Except Springfield, Mo., and Pontiac, Mich., probably all American trickling filter plants distribute the sewage over the beds by means of fixed nozzles; whereas in most of the English plants traveling distributors are used, the outstanding exception being the large Birmingham sewage-works; but the beds recently added to this plant are provided with traveling distributors.

During a recent visit to England the author learned that there were two main reasons in the mind of the English designer for the traveling distributors: (1) more uniform distribution and (2) reduction of odors. It was also claimed that the maintenance was less in man-hours for traveling distributors, being reduced to zero by the newest type of distributor at Leeds.

Birmingham—Uniform distribution minimizes ponding, increases the capacity of the beds and produces a more uniform effluent. It has been found, particularly at the large Birmingham plant, that the spraying of the sewage several feet in the air above the beds gives the sulphuretted hydrogen ample opportunity to escape into the air, which, if light, carries it upward and onward, until low barometric conditions bring it down to earth again a mile or more away from where it started, resulting in most unpleasant odors to those who are unfortunate enough to be within the zone of the vapor cloud.

FIG. 1—GRIT CHAMBERS AT SEWAGE-WORKS OF LEEDS, ENGLAND
Grab bucket operated by traveling crane on traveling platform dredges grit from any one of the four chambers and dumps it into wagons or carts alongside, which take grit to nearby dumps.

This has caused so many complaints from the residents near the Birmingham beds that two methods for overcoming it are being carried out. The first, which has been in operation for a few years, is the addition of about 7½ acres of trickling filter beds equipped with the Fiddian traveling distributors. The second is the installation of an experimental 2-m.g.d. (imperial gallons used throughout this article) activated-sludge plant designed to reduce the organic matter about 60 per cent (measured by oxygen absorbed). The effluent

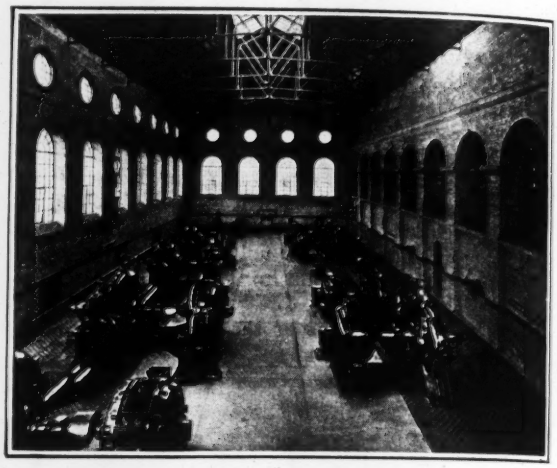


FIG. 2—MOTOR-DRIVEN SEWAGE PUMPS AT LEEDS
Low-level sewage, after having been passed through coarse screens, grit chambers and preliminary settling tanks, is pumped to high-level channel where the combined flow is chemically treated before going to main settling tanks and thence to trickling filters.

from this plant is fed to the trickling filters, produces no odors and increases their capacity three- to four-fold. If this experiment proves as successful as it now promises, the present trickling filters will have sufficient capacity for a much larger population than now contributes sewage to the works. The excess activated sludge produced from the plant is discharged into the secondary sludge digestion tanks at Minworth, mixing with the main body of the sludge produced by the precipitation tanks at Saltly.

Bradford—The results of these experiments at Birmingham have led Mr. Garfield, chief engineer of the Bradford sewage-works, to conduct experiments along the same lines with a view of increasing the capacity of the trickling filter plant he is now building and decreasing the probable odors therefrom. Bradford produces what is probably the hardest sewage in England to treat successfully. It is the center of the largest wool scouring industry of the world. Its sewage carries an average of 900 p.p.m. suspended solids, 45 per cent of which are wool scouring wastes which produce 42 per cent of grease. The suspended solids contain from 20 to 25 per cent albumenoid nitrogen.

Mr. Garfield is building what will be when completed the largest area of trickling filter plant in England. It is designed to treat 16 m.g.d. average flow. There will be 60 acres of beds, 5 ft. in depth. This area provides for a rate of treatment of 0.32 m.g.d. per acre, which is about one-half the rate the English works are designed to treat. Before reaching the filters the sewage is passed through 20 primary settling tanks having

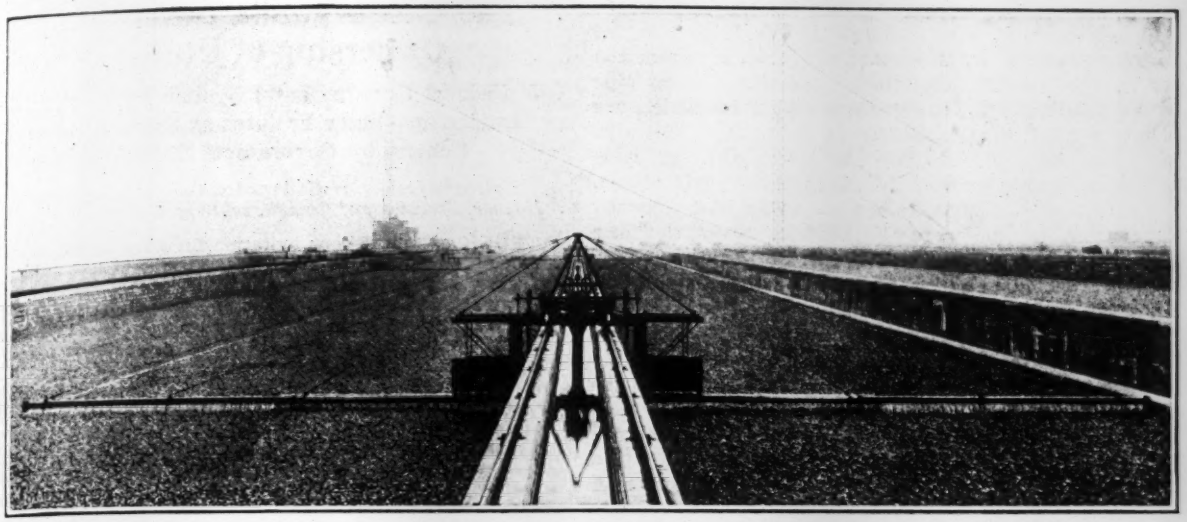


FIG. 3—FIDDIAN TRAVELING SEWAGE DISTRIBUTOR IN USE ON TRICKLING FILTERS AT LEEDS

Sewage siphoned from feed channels passes through a waterwheel which drives the distributor. Sewage then goes to perforated sprinkler pipe. At each end of the run of the distributor a tripper reverses the motion of the latter by changing the wheel operation from overshot to undershot and vice versa. To give a longer rest period between dosings, only half of each distributor arm operates at a time. In the distance may be seen concrete elevators and chutes which are being used by contractor in enlarging the filtration plant.

a combined capacity of 8 m.g. Twenty secondary settling tanks having a combined capacity of 11½ m.g. are also provided principally to take care of storm-water flow which reaches the works and is 1½ times the average dry-weather flow. Traveling distributors are to be used for the trickling filters. The plant will cost about $12,000,000, including several miles of main sewer from the city to Asholt where the works are located.

Leeds—The best looking sewage-works of the trickling filters type which the author has seen in England is being built at Leeds under the direction of G. A. Hart, chief engineer of the sewage-works. Leeds is a manufacturing city of 450,000 people and produces an average of 17 m.g.d. of sewage containing about 375 p.p.m. of suspended solids, 35 per cent being industrial wastes. The sewage reaches the works by two outlets, a high- and low-level, the former being 35 ft. higher than the latter. The low-level sewage, representing about 40 per cent of the total flow, reaches the lower works by gravity where it passes through coarse screens of the traveling fork type, detritus or grit chambers and preliminary settling tanks which afford a 12-hr. average detention period. The settled sewage is raised by electrically-operated direct-connected centrifugal pumps to the mixing channel at the beginning of the upper works where it combines with the high-level sewage. To this combined sewage ferric sulphide is added after which it passes through settling tanks affording from 8- to 12-hr. detention and from thence, by gravity, to the trickling filters. There are 24 acres of beds being built, 8 beds already being in operation. These beds are 6 ft. deep, composed entirely of crushed granite of selected size, instead of clinker so universally used throughout England. The designed capacity of the 24 acres of beds is 0.6 m.g.d. per acre.

The outstanding feature of these trickling filters is the distribution system. Mr. Hart has selected three types of traveling distributors: (1) The Fiddian type, consisting of an overshot wheel (undershot on reversing direction of movement of distributor) about 30 in. long, operated by the sewage siphoned from the feed channel under a 2- to 3-ft. head. The sewage leaving the wheel passes into and through a 4-in. pipe attached to and supported by the car which carries the wheel and which moves on a monorail built alongside the influent channel. This car is actuated by the water-

FIG. 4—JONES & ATTWOOD SEWAGE DISTRIBUTOR IN OPERATION AT LEEDS

The waterwheel which propels this distributor also delivers the sewage to the bed. The windshield at the center balances the machine so in case of high winds the car wheels will not drag on the monorail.

wheel and, after passing to one end of the bed, a tripper changes the direction of the revolution of the wheel, making it an undershot and thus impelling the car in the opposite direction. The distribution pipe is perforated with ¾-in. holes spaced ¾ in. which are about 16 in. above the surface of the filters. The pipe must be swabbed out daily to loosen the settleable solids accumulating about the edges of the perforations.

(2) The second type, known as the Jones & Attwood distributor, is similar to the Fiddian except that the waterwheel extends the full length of the distributor, and the perforated pipe is omitted, the distribution being effected by the wheel breaking the liquid up into drops which fall directly upon the stones. This distributor is also carried on a monorail and, like the Fiddian, its length is thus limited to approximately 18 ft. Each of these machines is equipped with a wind wheel on the top and in the middle of the machine for the purpose of securing an even balance so that the wheels of the car will not drag on the monorail in case of a high wind.

(3) The third type of distributor, and perhaps the one which will be adopted, is composed of an 8- or 10-in. pipe 95 ft. long, each end of which is supported by a carriage running on a monorail. The sewage is siphoned from the influent conduit, passes into this pipe and through large perforations, not easily stopped up, and falls upon a saucer-shaped plate with such force as to cause the sewage to splash out in all directions. This distributor has several advantages over the other two types. It covers five times the area, can be operated at variable speeds according to the motor speeds, and needs no cleaning as the feed holes are too large and the flowing-through velocities too great to permit of stopping up. Because the machine is five times as long, several feed channels and carriage supports needed for the other types of machines can be eliminated. Mr. Hart is now operating the third type of distributor by means of cables which are actuated by a motor located at one end of the bed similar to the original installation which Mr. Potter designed for Springfield, Mo., but he expects to actuate his next unit with a motor at each end of the machine, so synchronized as to insure against end drag. The power required to actuate the present unit amounts to 1 B.hp. per million gallons of sewage.

No humus tanks are being provided for the effluent from the Leeds filters, the effluent passing directly to the river. The sludge from the settling tanks is pumped to the lower works, after about two grains of lime is added to each gallon of sludge, where it is dewatered from 90 to 65 per cent of moisture by means of presses similar to the Johnson type, as used at Bradford. Neighboring farmers haul the sludge away and use it as a low-grade fertilizer.

The Leeds works, now under construction, will cost about $8,000,000. The filter beds, including distributors, are costing $80,000 per acre. Mechanical distributors cost more for equipment than fixed nozzles, but are much more efficient. This is quite apparent at Birmingham where the two systems are operated side by side, and where a considerable percentage of the surface of the filter beds supplied by fixed nozzles is dry much of the time. At Salford, where fixed nozzles alone are used, the author estimated that 20 per cent of the area was out of use and much of the remainder badly ponded.

The Case Against Government Ownership of Utilities

Our Federal Governmental System Inadequate for Ownership—Some Failures as Evidence—But Control by Government Successful

Extracts from a radio broadcast address by Herbert Hoover, Secretary of Commerce, Sept. 30, 1924.

MUCH of the present agitation for government ownership of utilities is based upon conditions, not as they are today but as they were a generation ago. There were then great abuses that called for remedy. There is scarcely a single utility today that is not under public control through some governmental commission, local or national. These commissions today fix the rates, the issues of stock, the time-tables, the car service, the profits. Our great national water powers are reserved to the government through fifty-year leases, under public control. And our commissions are not alone preventing abuse; they are maintaining initiative, enterprise, and progress in our railway and other utilities, as witness their enormous growth and constantly improving efficiency and service.

Regulation has, through stabilizing rates, reduced the cost of capital by increasing the security for the savings of our people. From this security and within our generation there has come a new tide, and that is toward popular ownership as distinguished from government ownership. These enterprises are no longer owned or controlled by a few. A silent revolution is transferring ownership to the public. Moreover, the new generation of administrators of these enterprises has firmly grasped its responsibility to the public. There has been a genuine growth of business conscience and service, and this growth is far more precious than any amount of legislation.

Of those individuals who fail to manifest this sense of public responsibility I could speak with bitterness, for they are the real stimulators of socialism. Such men give the cause for the despair that government ownership is the only relief from their actions. But we do not put the whole people in jail because of occasional murders.

If the American people have not the intelligence, if they have not the character, if they have not the political mechanism by which private competition can be maintained and yet abuse can be prevented, then they do not possess the character or the political mechanism by which they can undertake the gigantic operation of these enterprises.

Governmental Service Inadequate—Neither our national nor our state governments are planned or equipped for the task of government operation of utilities. The very first fundamental difficulty that our form of government presents is the relation of the states to the federal government. For in our plan we conceive that liberty requires a great measure of decentralization in authority. If these public utilities are to be operated by the federal government we at once deprive the states of their measure of authority and control over railway, power, light, and communication companies—we make the service in these states dependent upon the will of Washington, thousands of miles away. It is an impossible conception that we give the states the power to regulate the business of the federal government as they now regulate these services. Or are we going to divide the railways and power and communications into forty-eight systems, each ending at the boundary of its own state? Whichever we do will crack the timbers of our government.

If we pile these forty billions of business and two million seven hundred thousand employees upon the government, one of two things happens. Either the 530 members of Congress or the hundreds of members of state legislatures become their real boards of directors, or, as it has been claimed, these great businesses could be placed in the hands of non-partisan commissions or government corporations, somehow free from politics and the dead hand of bureaucracy. Neither alternative will work. If we were to set up such agencies, so free from restraint of the Congress and legislatures as to accomplish these objects, we would have created gigantic despotisms controlling the well-being of our whole people—and, incidentally, controlling the very

election of our officials. As a matter of fact, we can do nothing of this kind if we are to maintain a democracy. We can not have a democracy and deprive our elected representatives of their control of government investment, their power to fix salaries and wages, their independence in the investigation of the conduct of public officials. The reservation of any or all of these powers renders any kind of a commission subservient to the members of legislative bodies, no matter what the theory is. When they are subservient to elected officials, politics will be their daily need. Above all, the members of our legislative bodies represent districts, states, parties, and groups of opinion. Each member is expected by his constituents to look out for their local or group interests first, and he is elected upon the results he obtains. Partisanship, "log-rolling," and politics would be the inseparable accompaniments of administration. No great business can be efficiently administered by such a board or on such a basis of choice.

Also these legislative bodies would have to deal with group pressures striving for favors in rates. The relative rates will affect the prosperity of every city and every section, every group and every industry. States, counties, farmers, town dwellers, every group of manufacturers, will press their representatives to secure an advantage, and legislators will inevitably honestly favor their constituents. Every experience to date indicates that the taxpayer will pay for the resulting concessions.

By this vast venture that is proposed to us we would at once increase the total of national and local officeholders up to about six millions. The rightful interest of this group is in higher pay, constantly better conditions of service, and better standards of living. The rightful public interest will be to hold down rates and taxes. These interests will clash, and their clash must fight itself out not on grounds of economic bargaining between labor and employer, but in the political arena. The voting strength of this mass of office holders, their wives and dependents, will be over 25 per cent of the whole. It is the balance of political power between parties in every district.

Higher Rates—Unless the federal or local governments can give the public lower rates, there is no use in undertaking the gamble.

If the government is to reduce rates it must do so either by the saving of private profits or by reducing operating expenses or lumping them on the taxpayer. During the past four years the railways have on an average earned less than 4 per cent on the Interstate Commerce Commission valuation. Even if this value were reduced by 25 per cent, they would have earned only 5 per cent. Our electrical utilities are regulated at earnings between 6 and 8 per cent upon their invested capital. The government could not borrow the huge sums necessary at less than 5 per cent.

In a sale to the government the constitutional requirements would, for various legal reasons, probably result in a much larger sum than the forty billion dollars of present valuations by commissions and others.

Moreover the wasteful distribution of the hundred and fifty million of capital invested annually in the Post Office, Reclamation Service, Shipping Board, rivers and harbors and roads, would not be a patch on the waste in appropriations when our legislative bodies get a chance to handle two billions per annum of new capital outlay. For all these reasons I am convinced that interest charges alone to the government would be larger than the present utility profits, and no economy lies there. Rather that is the way of the prodigal.

Nor can the government operate as economically as private enterprise. If we take over nearly three million new employees into public service we must put them under an airtight civil service, to be hired by a separate commission and promoted by seniority and at once we have created a bureaucracy. Otherwise, we would have nearly three million jobs to be given out and a political debauchery unparalleled in all history. There are certain inherent qualities of bureaucracy in its deliberative action, the necessity to maintain joint responsibility, its enlargement of "red tape" designed to prevent error in judgment and conduct all of which are perhaps an advantage in purely governing functions, but they become disaster when applied to the rapidity of movement vital to business and service. Numbers increase for every task. The alternative is political favoritism. And at the top where exceptional talent and genius must be had, neither seniority, nor competitive examination, nor politics will secure or find it.

Poorer Service—Nor will the public secure better or more impartial service under government ownership. The action of all government officials must be limited by a vast amount of regulation and "red tape." Therefore, government employees never can yield that spirit of accommodation that employees of private enterprise must furnish in order to maintain the repute of their competitive enterprise and its standing in the community.

Increased Taxes—Another question worth examining is the direct and indirect tax burdens which will be imposed upon the public, assuming always that rates pay operating expenses and interest. The addition of $40,000,000,000 to the national debt differs much from the debts of many thousand of private enterprises now comprised in these public utilities. The failure of a single private enterprise is a loss to its owners only, but with this entire investment transferred to the government every citizen would pay every loss of capital, directly or indirectly from taxes or rates, whether he liked it or not.

Employees Worse Off—The next question to examine is whether the employees would benefit by being incorporated into the government service. The first and foremost result of such an operation would be a dispute over the right to strike. It is by no means certain that a government can continue as a government and admit the right of government employees in vital services to strike against it. Nor can legislative bodies delegate the right to settle wages and salaries to any commission or they will have delegated their control over expenditures, which is one basis of democracy. In any event, under government ownership employees must in the final analysis bargain with legislative bodies, and bargaining will rest not upon economic need or economic strength, but on political potence. The present federal employees, denying themselves the right to strike, have just now, after eight years, succeeded in getting some of their deserved increase in pay. The public utility employees have had them already for years. Their wages are today the highest real wage in the world. Some have assumed that the political strength of this great mass of employees will enable them to dictate the election of legislative members and thus secure their desires. This means the creation of another bloc, the arraying of class against class, perhaps the most dangerous tendency in our politics today.

Conclusions—Our government has some necessary power interests of its own. The building by the government of great control dams, as on the Colorado, the St. Lawrence, and elsewhere, whose primary functions are water supply, or control of flood, or irrigation, or navigation, and where power is a byproduct, is a far different thing from the government's going into power production and distribution as a business. Some of our municipalities are faced with these problems and sometimes they also have a desire for business adventure, but the withdrawal of over 400 municipalities from efforts to run utilities are themselves indication that even under local concentration of authority the results are doubtful enough.

I could at great length enter upon a discussion of the costs and failures of government ownership and operation in our own and in other countries. . . . But as grievous as all these failures have been, there is still the fact that it is our government and institutions and our people that we are dealing with and not those of foreign countries; and our own institutions, designed more for liberty and less for business, would fare far worse.

We have constructed our government upon the theme that its major purpose is to preserve human liberty amid the changing social and economic scene. If we divert it to the changing of money we shall have lost sadly for the future.

And paralleling and paralyzing every argument against government operation is one insistent note. That is the preservation of the vital initiative and enterprise of our people. This is the mainspring of progress. Bureaucracy is the dead hand on initiative. Government can correct abuse without entry into business. If it can not, then democracy shall have failed.

Sinking Pier Caissons for Four Missouri River Bridges

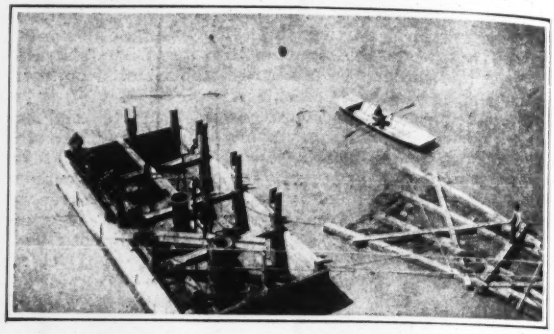
Subaqueous Difficulties Met by Missouri State Highway Department on Structures Now Under Construction

By L. J. Sverdrup
Bridge Engineer, Missouri State Highway Department, Jefferson City, Mo.

IN SINKING pier caissons for the four federal-aid highway bridges being built by the Missouri State Highway Department across the Missouri River, so diverse have been the subaqueous conditions met that a fair estimate of the river's bed along a 100-mile stretch has been acquired. This information may both assist designers in future crossings of the Missouri and be of sufficient general interest to make special note of here.

The bridges are being built at Lexington, Waverly, Glasgow, and Boonville, making four crossings within a stretch of river of less than 100 miles. The crossings were selected with consideration for traffic, cost of construction, and future expenditures in river channel control. Of the four, the crossing at Lexington was the most difficult to decide upon as the river channel at that point did not appear to be definitely established so as to eliminate danger of channel changes after the structure was built. At Waverly the channel seemed fairly well established and the river was held well in control by pile dikes constructed by the War Department, upstream from the bridge location. Both at Glasgow and at Boonville the proposed crossings were close to railroad bridges already in operation, so it was felt that these crossings would be satisfactory. Nevertheless, possible channel changes have been taken into account so that bank protection can be immediately constructed in emergencies.

All the bridges are of the riveted through truss type, with spans varying in length from 250 to 420 ft. Girder and deck trusses of length up to 210 ft. form the approach spans. The bridge at Lexington is the longest, having a total length of 3,066 ft., of which 372 ft. is of steel trestle construction, 630 ft. of deck trusses, and 2,064 ft. of through trusses. The other bridges vary in length from 1,940 to 2,665 ft. approximately, all having channel spans of over 400 ft. With the exception of the Boonville bridge, the structures have clear

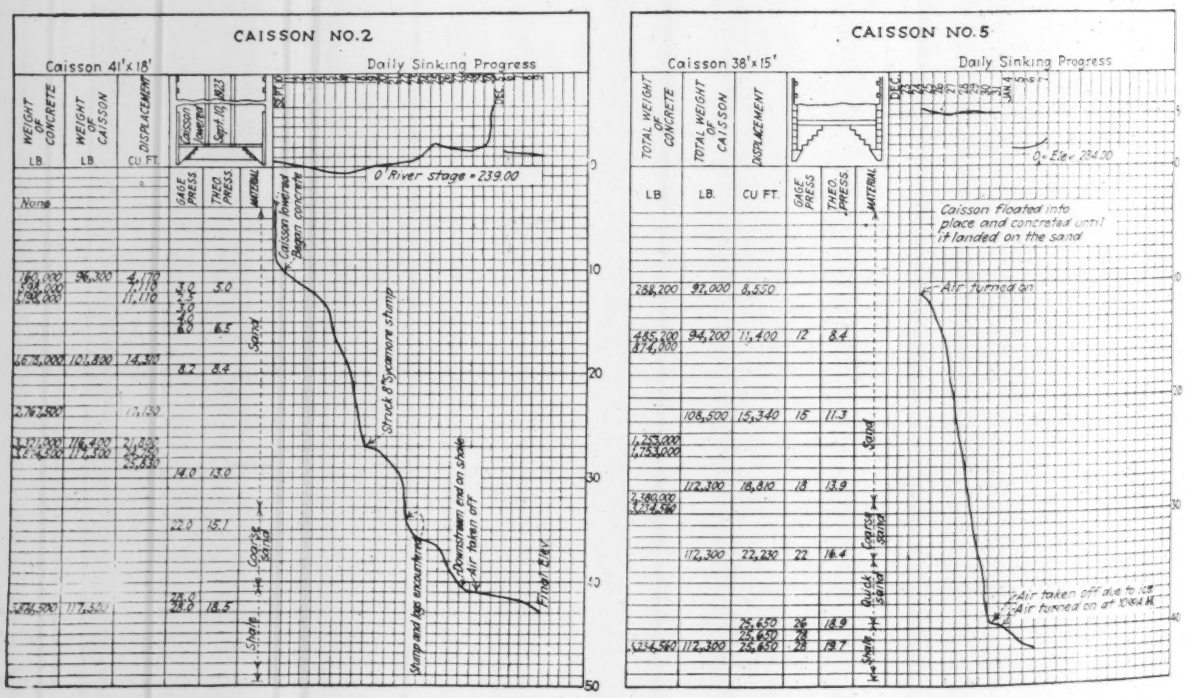


MOVING GLASGOW CAISSON TO PIER POSITION

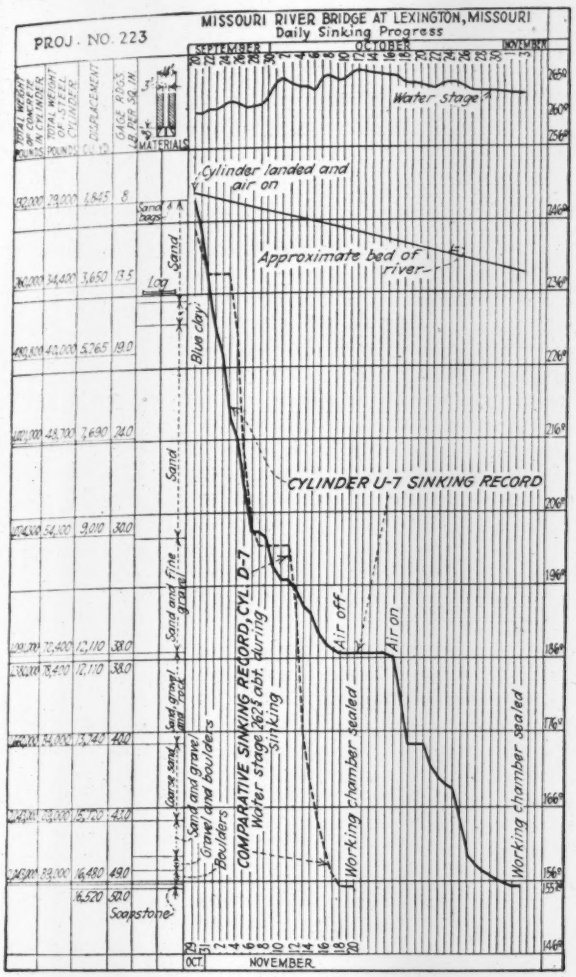
roadway widths of 20 ft., with concrete floor and curbs. The Boonville bridge has an 18-ft. roadway and a wooden floor with 1½-in. wearing surface.

All of the piers are carried to rock and either into rock or anchored securely in some manner. The piers at Glasgow go to the least depth and those at Lexington to the greatest, more than 110 ft. All piers were sunk by the pneumatic process, air pressures up to 52 lb. per square inch were used.

At Lexington two steel cylinders were carried down. On the other projects wooden caissons were used, the Morrison box with knee-braces being used at Glasgow



CAISSON SINKING CHARTS ON TWO WAVERLY PIERS



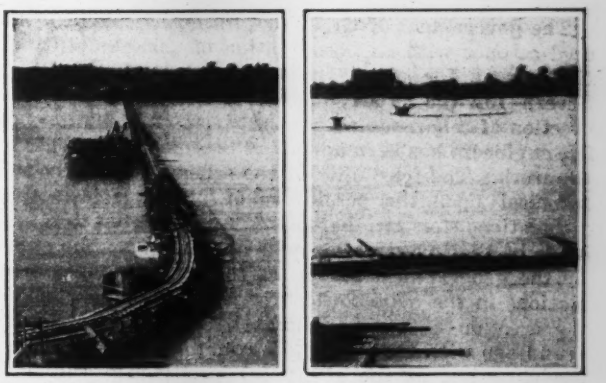
CHRONOLOGY OF CAISSON SINKING AT LEXINGTON

and a stepped-up section for the working chamber at Boonville and Waverly. The latter type is much smaller than the straight-wall chamber and therefore has several advantages over it; two of these are that the pier will sink more gradually, due to its weight and to the smaller cushion of supporting air, and that the pier when sunk to its final position requires less concrete to seal the working chamber. In sinking the caissons a variety of materials were encountered, such as sand, gravel, clay, hardpan, shale, coal, and limestone. Sand and fine gravel could be handled through the blowpipes without any difficulty, the bucket lock being used when coarse gravel and boulders were encountered.

At Waverly, a very satisfactory way of getting material out of the working chamber was devised by L. R. Canfield, superintendent of construction. The most commonly utilized method (that of having the discharge pipe extend through the roof of the working chamber and the concrete in the base, and finally bend and run over the edge of the caisson) works well, except that a thick section has to be used where the pipe is bent to withstand continuous wear and tear of sand and fine gravel being discharged. Instead of using this gooseneck, Mr. Canfield used a T-section, but ran a continuation of the vertical pipe up past the horizontal pipe. In this way material discharged encountered an air cushion instead of a metal section. During the entire sinking, a discharge pipe never wore out on the Waverly work. Another advantage of this method lay in the fact that the horizontal discharge pipe could be left in the concrete instead of having to be raised as the base was poured. This meant less pressure required to expel material as the vertical lift is not so great as it would be were the pipe changed with each pour of concrete. When a new horizontal discharge pipe was needed, connections were made on the vertical pipe and the discharge end of the old horizontal pipe was plugged.

At Waverly all the caissons, except one, were built on a lowering dock and settled in place by six lowering screws. That one caisson had to be built on a barge and floated to position because the current was too great to get a lowering dock driven. At Glasgow, a different method was adopted owing to the fact that the highway bridge under construction is very close to an existing bridge of the Chicago & Alton R.R. Here the caissons were built on a dock, lowered and floated into position. As the spans on the bridge under construction and the bridge in place are of the same length, the caissons were anchored to the Chicago & Alton piers and held in place during the first period of sinking. The Lexington cylinders were all lowered from a lowering dock, a tramway being used. A tramway was also used at Waverly. Construction of river piers at Glasgow and Boonville was carried on by means of barges.

In sinking the 17 caissons and 22 cylinders, a variety of obstacles, such as large boulders, logs and stumps, were encountered. Pier No. 2 at Waverly was held up by a sycamore stump 8 to 9 ft. in diameter. Fortunately, the stump came in the center of the box. Had the cutting edge landed on the stump it would naturally have required more time to cut it out and get the caisson past it. It was difficult enough, for the crossbeams of the caisson rested squarely on top of the stump and threatened to fracture the beams. At Glasgow a peculiar condition was encountered. A short distance above solid rock a nest of rocks was found



WHAT HIGH WATER DID TO WAVERLY TRAMWAY

mixed with kegs of nails, carpenters' tools, crowbars, and cables, apparently material which had been thrown into the river during the construction of the Chicago & Alton pier.

During the sinking of the first cylinder in the river proper at Lexington, considerable trouble was encountered in keeping the cylinder in its proper place; though in most cases a caisson will work upstream, this one worked downstream. When the cutting edge was 40 ft.

down it was about 17 in. downstream. Several methods were tried to get it back again. The top was leaned downstream in an effort to walk it back, and piles were driven along the downstream side of the caisson. It was found, however, that the leaning process did not accomplish the desired results because air escaped under the cutting edge and passed up through the material next to the walls, agitating the material to such an extent that it became too yielding to afford bearing. The air was then taken off so as to let the material, which was mostly silt and sand, pack around the caisson. When the air was turned on again as little as possible was used, with the result that the caisson, when finally landed, was only about 8 in. off its true position. Though this was the most marked case, difficulties were encountered in landing a majority of the caissons and cylinders.

The bridges are under the general supervision of J. A. Williams, who represents the state. The Lexington bridge was designed by J. A. L. Waddell and the general contract is held by the Kansas City Bridge Co.; the Union Bridge & Construction Co. is building the substructure. The Waverly and Boonville bridges were designed by Harrington, Howard & Ash, and the Missouri Valley Bridge & Iron Co. has the contract for the superstructure of the Waverly and the substructure on the Boonville bridge. The contract for the superstructure for the Boonville bridge is held by the Mount Vernon Bridge Co. The Glasgow bridge was designed by F. W. Adgate. The substructure was let to the Union Bridge & Construction Co. and the superstructure to the Mount Vernon Bridge Co.

B. H. Piepmeier is chief engineer of the Missouri State Highway Department. J. R. Chamberlin, senior bridge engineer of the Bureau of Public Roads, has represented that bureau in advising the state on federal policies and practice. James C. Wonders is district engineer of the bureau, with headquarters at Omaha, Neb.

Severn Barrage Scheme Revived

The government of Great Britain has decided to proceed at once with an investigation of the feasibility of the scheme for using the tidal power of the River Severn for the production of electric power by the erection of a barrage across the river. A committee of five engineers has been appointed to supervise and direct the work. The feasibility of the scheme turns first and foremost upon the possibility of finding satisfactory foundations for the barrage. Accordingly, the first stage of the investigation will involve: (a) the study by the geographical survey of the stratigraphical formations in the neighborhood of the sites suggested for the erection of the barrage; (b) taking preliminary soundings with the view of determining the contour of the river bed at the sites; (c) preliminary measurements of the flow of water at different states of the tide. In the meantime two consulting engineers, Sir Maurice Fitzmaurice and Sir John Purser Griffith, have been invited to submit a joint report by the end of the year as to the possibility of constructing a barrage on one or more of the sites suggested on the assumption that safe foundations exist. The data which will be provided as a result of the geological and hydrographical investigations already mentioned will be placed at their disposal. The staff of the Geological Survey have already begun the inquiry entrusted to them.

Saving Money by Leaving Concrete Floorbeams as Ceiling

Economy and Appearance May Both Be Served in Concrete Buildings by Discarding Flat Ceiling Idea

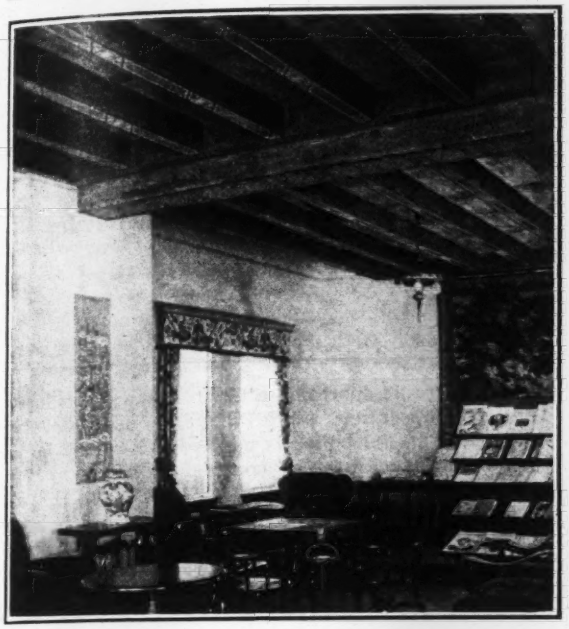
By Robert D. Snodgrass
Chief Supervising Engineer, Truscon Steel Co., Youngstown, Ohio

For a number of years there have been no new developments in fireproof construction. Engineers have been applying themselves more to the standardization and simplification of the methods already in use rather than upon new applications of materials. Structural shapes have reached the point of maximum economy, reinforced-concrete specifications are standardized and the list of available fireproofing materials is about complete. Many years have passed since the last modification in steel structural shapes and still more years since an improvement has appeared in deformed reinforcing bars. Nor has any important change occurred in methods of manufacture or application of other fireproofing materials that tend either to improve their quality, widen their field of usefulness or decrease their cost.

The necessity for economic design and methods of construction have never been more important than today. Rising labor costs both in the factory and field are the most disturbing factor in building construction. The need for building, especially for housing purposes in congested districts, has never been more acute but prohibitive costs are either preventing it entirely or producing less permanent or satisfactory types of buildings.

Artistic Appearance and Economy—For these reasons the problem of the engineer and architect of today has changed. There is no longer a field in which new and less expensive materials for fireproofing construction are to be found. The only means left for combatting continually rising cost is to study methods now in use and to combine them with greater economy. There are many ways of reducing building costs without sacrificing either strength or architectural effect. A very fine example of what can be done may be found in the new City Club of St. Louis.

In designing the building the architect, T. P. Barnett, of St. Louis, was confronted with a building project covering a lot approximately 62 ft. wide by 132 ft. deep and 16 stories in height, and requiring a definite number of square feet of rentable area of income producing capacity which would enable the club to secure a loan in sufficient amount to erect the building. With this in view he was called upon to make radical economies in the cost of construction, but these had to be accomplished without lowering the standard of quality and architectural design which is necessary in a building of this character. After careful study a reinforced-concrete frame was adopted in which the floor slabs were centered by means of metal tile. Below these all metal lath furring was eliminated throughout the 16 stories, resulting in a saving of lathing and plastering of approximately $50,000. No unusual effort was made to secure a fine finish for the concrete surfaces. The joints between the members of both the wood beam centering and the sections of the steel forms were not



SIMPLY DECORATED CONCRETE BEAMS FORM CLUB ROOM CEILING

The reading room of the new St. Louis City Club. Showing how decorative is the utilization of the purely structural elements of the reinforced-concrete floor.

dressed down to a smooth surface nor was any effort made to eliminate from the concrete the marks of the wood graining.

The design of the club is early Italian Gothic and the exposed beams which were left after the removal of the metal tile gave a beamed ceiling of character infinitely superior to a flat plaster ceiling, at the same time adhering thoroughly to the tradition of early beamed ceiling effect especially exemplified in the Davanzati Palace at Florence, Italy, and in many other notable Italian structures. The beams and ceilings were stained in imitation of walnut. The soffits of the beams and girders were decorated in polychromatic designs of a simple character. The effect of this finish together with the character of the concrete surfaces can be clearly seen in the interior view of the club reading room presented herewith. It has been the general expression of all who have seen this treatment that the results have been unusually successful, so much so that Mr. Barnett has used this same design in the brokerage office building for Lorenzo E. Anderson & Co. In this structure he was confronted with the same problem of expense as in the City Club, but in the latter case a still further economy was gained by leaving plaster off the walls and substituting brick interior. This building is a pronounced success both from an artistic and an economic standpoint.

There is an enormous amount of building construction required which is being held back indefinitely on account of prevaling high costs. It is the architect's and engineer's problem to meet this condition and to revise much of our prevailing practice. The two examples described above prove that a plastered ceiling is not a necessity. Our architects can do a great deal to help by leading the American people away from the over-decorated styles now prevailing and returning to more primitive ideals; and in accomplishing this concrete and reinforced concrete is the answer for a large part of the successful building of the future. There is in reinforced concrete an opportunity to break away from much of the over-decorated brick and terra cotta buildings and the ephemeral wood construction to a more esthetic, more lasting and simple architectural treatment.

Application to Home Building—While devising means of reducing the cost of fireproof construction it is not beyond belief that with a constantly rising tendency in the price of good lumber, we are approaching the time when fireproof residences can be built at a cost equal to or a little less than wood joist construction. The methods described here can easily be adapted to home construction. In fact with proper study the simpler fireproof designs may be made even more artistic and beautiful without the inevitable cracks which occur whenever wood joints and lath are the support for a plaster finish.

The accomplishment of this result would be of such enormous benefit that it is well worth the effort of the best minds in the country. It is only necessary to refer to the records of the United States Senate Investigation Committee of 1920 to learn that during the year 1917 there was a total residential loss by fire of $63,000,000, enough to build 16,000 homes at an average cost of $4,000, and that more recent years have an equally appalling record. Most of these fires have started from the inside and would not have occurred in fireproof construction.

The methods described above would increase the cost of the average small residence containing approximately 2,500 sq.ft. of ceiling area but would reduce the plastering costs by about $750. This is about the same amount that the substitution of reinforced concrete for wood joist floors adds to building construction especially if cement finished floors are substituted for wood. It is true that there is a prejudice against cement floor finishes in residence work, but so much progress has recently been made along these lines especially in high grade apartment houses that any prospective builder willing to investigate is not likely to hesitate for any great length of time. Who would hesitate, when it is proved that a cleaner and more permanent and sanitary home can be built at the same cost as dangerous wood construction?

Norway Builds Roads With Unemployment Funds

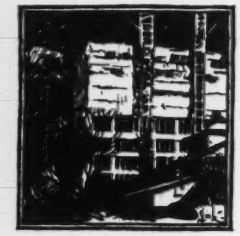
Norway has been solving the problem of unemployment by appropriating funds for productive work, thereby utilizing labor otherwise idle, says a report from A. E. Fenselau, secretary to the Commercial Attaché at Copenhagen, Denmark. The Norwegian legislature has appropriated funds totaling 180,000,000 crowns, 5,000,000 crowns having been recently voted. Of the total, 140,000,000 crowns have been applied on productive work, much of it on highway construction. The Norwegian Director of Highways recently announced that since the inception of the relief work 450 km. of main highways and 250 km. of other roads have been constructed. In addition to this, many workers, paid from the unemployment grants, have been engaged in emergency projects for the railways and in road construction work for municipalities.

Winter Construction

As the Contractor Regards It

III. METHODS AND COSTS

Skill and system in protecting construction from exposure have reduced direct winter costs to a low figure.



The Third of a Series of Four Articles

By C. S. HILL
Associate Editor, Engineering News-Record

WINTER methods in construction are operations especially directed toward reducing exposure and eradicating frost. They are: increasing frost resistance; thawing and removing snow and ice; heating and insulating forms; blanketing exposed surfaces; housing; heating enclosed spaces. With the summary of costs which follows they epitomize the contractor's technical equipment to make winter work an economic possibility.

Increasing Frost Resistance—Addition to concrete of certain compounds, such as salt to lower the frost point or calcium chloride to quicken setting, is effective where only a few degrees of frost have to be guarded against. In general these chemical hardeners have a field limited to isolated small operations or especially thin sections or slabs at temperatures, let it be repeated, not much below freezing. Calcium chloride, however, stands out beyond other compounds for its possible service to concrete road contractors. Experience in its use as a curing agent to get pavement more quickly under traffic promises so much that experimentation with moderate frost conditions is in order.

Thawing and Snow Removal—Two cases of snow removal have to be considered: (1) Snowfall which has to be cleared from tracks, roads, structures and working spaces, and (2) lodged and frozen snow which must be removed from forms and surfaces.

For snowfall removal, sweeping, plowing, shoveling, and hauling used everywhere and for all time are employed. The change that is noted, as in city and railway snow removal, is the use of power and machinery. On a large operation in northern Quebec, with some 35 miles of service track, a standard railway snow plow is operated with excellent effect and economy. Job roads and working spaces do not ordinarily offer the best surfaces for machine snow removal but with a tractor and a V-plow or a blade grader many more places than would be expected can be got at effectively. A notable tool is the tractor with crawler traction. It will make its way through deep snow over rough ground and pull or push plows and scrapers where other means of traction will fail.

Removal of lodged snow and ice from forms and surfaces to be built upon and worked over is a more particular task. Scraping and sweeping are time-honored and also time-consuming methods but they are effective and often they are the only practicable methods. For clearing forms and surfaces to be built upon steam thawing is unsurpassed. Practice has been worked out most thoroughly in building construction. It calls for a separate boiler and from it a 1½-in. steam line up the hoist tower with a cock for hose connection at each floor. Stress is laid on ample boiler capacity. For a considerable operation a 60-hp. boiler is employed and in any operation where the area on a floor is 5,000 sq.ft. a 25-hp. boiler is advised. Steam at 50 to 60 lb. boiler pressure is considered necessary for efficient work.

There has been developed also a distinctly notable thawing technique for earth excavation. Steam point thawing as perfected in Alaskan placer mining is directly applicable to footing and basement excavation in frozen ground. In considerable operations the cost of thawing is 15 to 30c. a cubic yard in Alaska, where millions of yards of placer gravel have been thawed for gold dredging. The technique of steam point thawing is given in Technical Paper 309 of the Bureau of Mines, Washington, D. C.

Heating Materials—Heating the materials is the most widely used method of safeguarding winter concreting operations. Two practices are followed: (1) Heating both the aggregates and the water, and (2) heating only the water. Where aggregates are heated three methods are chiefly used: (1) Stockpiling over steam-pipe grids on the ground; (2) storage in bins provided with interior steam heating coils; (3) storage in heated warehouses. Mixing water is heated by injecting live steam into the mixer water tank.

By these methods and by conserving the heat in transit concrete at 60 to 65 deg. can be put into the forms and in massive work this has proved ample in numerous operations to prevent frost at temperatures as low as 30 to 40 deg. below zero. In a large Canadian concrete dam operation last winter, by heating the materials alone, over 100,000 cu.yd. of concrete were safely placed at temperatures normally below freezing and, for two months, normally below zero.

In general, in mass concrete work, contractors can by heating the materials and with reasonable form insulation and surface blanketing guarantee continuous work in any winter, barring occasional days of blizzard.

Form Insulation and Heating—With warm concrete, form insulation or heating are added precautions to conserve the heat. They ensure safety in placing comparatively thin sections. In building the Worcester, Mass., sewage treatment works in winter, walls 20 ft. high and 1½ to 2 ft. thick were concreted between forms built in sections 10 ft. high of 2-in. plank on 4x4-in. studs. The back of the studding for the lower 5 ft. of each section was sheathed and the space inside was filled with sawdust, shavings or straw. The top 5 ft. of the form was curtained and live steam was exhausted underneath. Concreting was carried at all temperatures above 15 deg. above zero. In power plant construction at Devon, Conn., in the winter of 1923-24,

retaining walls were built without a concrete failure with warm mix placed between wood forms heated by steam coils. The forms were built in sections and the steam pipe was looped back and forth across the sections and curtained with canvas.

These two examples typify form insulation and heating of which there have been hundreds of successful applications, some much cruder and a few more elaborate. The methods are applicable particularly to bridge piers, retaining walls and other isolated, exposed structures.

Blanketing—Covering concrete surfaces with a blanket of canvas, straw, manure, dirt or water is a protection of limited application at not very low temperatures. It is employed chiefly in floor, sidewalk or pavement construction or for over-night or other temporary insulation of surfaces to be built upon.

Housing and Heating—Housing and heating the inclosed space, with the use of heated concrete, are the standard methods of winter building construction. As practiced by one of the most experienced concrete building contractors the methods are:

"Support the canvas on wooden frames resting on the column reinforcement about 18 in. above the floor and hang curtains from the exterior columns. The curtains should be carefully lashed to the underside of the floor below, care being taken to have the canvas some distance from the exterior forms so as to provide a circulation of heat. Then a curtain hung across the width of the building under the forms will shut off the section to be concreted.

"Enough salamanders should be provided to maintain a temperature of from 60 deg. to 80 deg. F. in this section. This will usually require one salamander to every 300 sq.ft. of floor area. The side curtains should be in place and the fires started in the salamanders as soon as, or before, concreting is started, and in extremely cold weather the curtains should be in place and the fires burning for several hours before beginning to deposit concrete. As soon as one bay of the slab is concreted it should be covered and in general all work should be closely followed with protection.

"Where the bays are not over 20 ft. square, provide one heat-hole about 8x12 in. through the slab so that circulation of heat may be maintained over the slab. In larger bays, provide a heat-hole for each 300 sq.ft. of floor area. These heat-holes should have beveled sides so as to make the filling plug of concrete perfectly secure. When the canvas is removed the heat-hole should be covered with boards.

"It is the best practice in winter work to concrete the columns at the same time as the floor and in this case great care should be taken to tamp the columns to prevent shrinkage cracks between the slab and the column head. Tamping sticks should be left in the head of the column and for several hours after the floor is concreted tamping of the columns should be continued. If the columns are concreted the day previous to the floor slab the side protection should be in place, floor forms made tight and the tops of the columns covered to prevent the column heads from freezing.

"The most difficult places to protect from frost are the bases of exterior columns. It is frequently found that with a temperature of 80 deg. F. near the underside of the slab, a temperature below freezing will be found near the bases of the exterior columns. Hence, in extremely cold weather it is necessary to place a salamander on two sides of every exterior column. The bottoms of the columns may be further protected by packing the forms with marsh hay, or other suitable material. When unusual speed is required, or in extremely cold weather, it will be necessary to curtain the floor below and place salamanders around the bases of exterior columns.

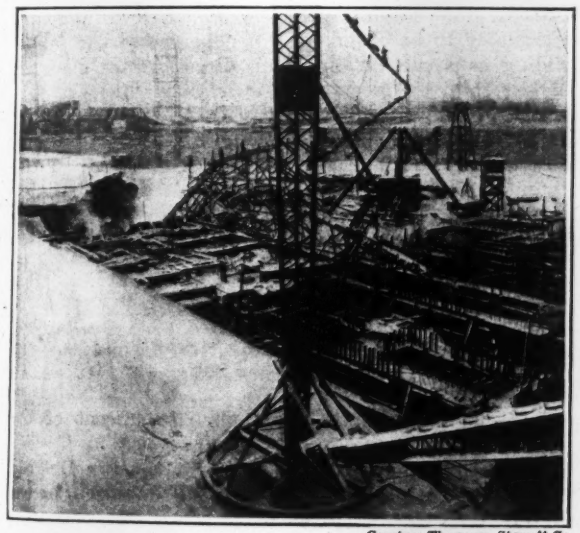
"This method of protection is also necessary when monolithic walls are carried up with the building as it is practically impossible to protect them from the cold unless heat is supplied from the story below. If the

DIRECT WINTER-BUILDING EXPENSE

From "Seasonal Construction and Unemployment," (Hoover Committee report)

Place	Approximate Total Cost of Building*	Direct Winter Expense	Per Cent of Total Cost	
Quebec	$1,000,000	$25,735	2 57	(1)
Massachusetts	1,100,000	40,327	3 67	
Massachusetts	315,000	11,091	3 52	
Massachusetts	375,000	24,776	6 61	
Connecticut	150,000	6,015	4 01	
Connecticut	250,000	7,153	2 86	
Connecticut	450,000	19,365	4 30	
Connecticut	2,000,000	42,550	2 13	
Connecticut	165,000	3,160	1 92	
Massachusetts	100,000*	5,800	5 80	
Connecticut	245,000*	6,419	2 62	
New York	425,000*	18,436	4 34	
Massachusetts	90,000	2,500	2 78	(2)
Maine	500,000	27,500	5 50	(3)
New Jersey	2,100,000	48,300	2 30	
New York	2,100,000	34,800	1 66	
New Jersey	1,240,000	7,800	0 63	
New York	745,000	31,200	4 19	
New York	380,000	15,800	4 16	
New Jersey	335,000	5,850	1 75	
Island St. Pierre	320,000	4,080	1 27	(4)
New York	220,000	6,600	3 00	
New York	175,000	4,880	2 79	
New Jersey	135,000	3,768	2 79	
New Jersey	83,500	3,350	4 01	
New York	83,000	4,476	5 39	
New York	53,000	3,350	6 32	
New York	700,000	30,400	4 34	
New York	180,000	5,090	2 83	(5)
New York	100,000	4,927	4 93	
			Average 3.50	

* Reinforced concrete except three of brick as starred.
(1) Temperature 20 deg. below zero while work in progress.
(2) Very heavy snow.
(3) Steam heating of space enclosed by canvas.
(4) Jobs of same contractor during severe winter of 1919-1920. (Two jobs done during mild winter of 1922-1923 averaged 75 per cent reduction in total labor item of the direct winter expense.)
(5) Estimated 10c. per square foot of floor area.



Courtesy Thompson-Starrett Co.

STEAM POWER STATION FINISHED LAST MARCH

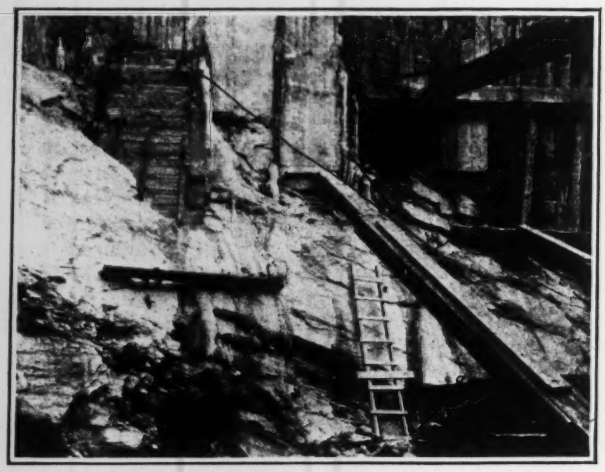
Heating mixing water and forms and placing concrete under canvas sustained the schedule in spite of several heavy Connecticut snowfalls.

walls are blank it will be necessary to provide openings in the forms to allow circulation of heat to the outside of the exterior walls. These openings should be about 8x12 in. and should be beveled downward and upward so as to prevent water from entering the building when the holes are plugged. There should be two such heat openings in each panel between columns."

Conclusions—By methods in which the operations named have differed only in detail and with the use of modern equipment the contractor has performed and is prepared to perform regularly any ordinary construction operation in winter.

Economics and Cost—Winter construction as it influences industrial economics broadly is not especially the concern of the contractor. His specific interest is in economics as represented by comparisons of winter and summer work costs. Here is where actual figures count and the discussion which follows will be confined to the altogether too meagre records which contractors have been ready to give out.

In estimating winter construction costs for the Hoover committee report Sanford E. Thompson separates them into classes as follows: (1) direct winter expense; (2) relative labor costs; (3) indirect expense or overhead; (4) materials costs; and (5) capital time value. Except capital time value which involves the contractor only to the extent of increased interest in idle equipment, these costs are all construction costs proper—essentially contractor's costs. Relative labor productivity or cost in winter has been considered in the preceding article, *Engineering News-Record*, Oct. 2, 1924, p. 532. Let us follow the other classifications.

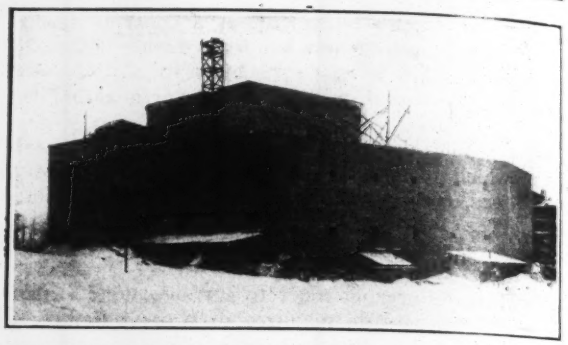


FROST CONDITIONS HAMPER FOUNDATION WORK

Photograph taken in January, on foundation work for large office building in New York City.

Direct Winter Expense—With all other conditions the same, winter adds the cost of shelter, heating, removal of snow and ice to the expense of construction. These are called direct winter expenses. Direct winter expense is not a constant, its ratio to total cost varies with every operation. Examples of actual costs are, therefore, indicative only.

Inquiry among Canadian general contractors developed a number of estimates which gave an average of about 10 per cent as the extra cost of winter work.



COMPLETE ENCLOSURE OF WORK OVERCOMES WINTER HANDICAPS

Not a day of time was lost in building this clubhouse in the Adirondacks. Enclosure and flood lighting were chief extra expense.

This figure is confirmed by an inquiry conducted by the Employment Service Council of Ontario. It is to be noted that the figure given is for general construction. There are reported instances where direct winter cost on large reinforced-concrete building operations ran as low as 3 per cent of the cost.

In the Hoover committee report Sanford E. Thompson gives perhaps the most extended record so far published of direct winter expenses of building construction. The table given herewith is slightly changed from the tabulation in the report. Two factors are particularly to be observed: (1) The records are all of building construction on which direct winter expenses are less than on most other operations; (2) the percentage of winter expenses in general decreases as the size of the operation increases.

On a $750,000 building built in New York in the winter of 1922-23 by John Lowry, Jr., the direct winter expenses are given as follows:

Temporary protection: labor and materials		$871
Tarpaulins, Cost	$667	
Salvage	442	225
Temporary heat: Salamanders		268
Coke		704
Labor (salamanders)		302
Boiler attendance, labor		1,036
Coal boiler heating		150
Temporary light, labor and service		196
Snow clearing		111
		$3,863

This expense total is less than 0.5 per cent of the cost of the work.

On three medium-size building operations in Detroit, Mich., in the winter of 1923-24, J. W. Robinson, of the Everett Winters Co., gives as direct winter expenses:

Item	1	2	3
Total cost	$355,000	$170,000	$85,000
Labor	1.4%	1.2%	
Materials, fuel, etc.	1.6%	0.7%	
Total winter expense	3%	1.9%	4%

On three typical reinforced-concrete building operations by the Barney-Ahlers Construction Co., William J. Barney finds direct winter expenses as follows:

Total Cost	Time Protection	Cost Protection	Per Cent
$263,000	Dec.—Jan.	$13,000	5
180,000	Dec.—Jan.	8,800	4½
95,000	Jan.—Feb.	6,300	6½

It needs to be emphasized again that these records are all of building construction. They are not notably extensive but there is no comparable record of direct winter expenses of construction other than building. Estimates can be had on every hand and they range from ten to fifty per cent, with the bulk of the most experienced contractors guessing 10 to 15 per cent.

Other Costs—Overhead expense per unit of work increases somewhat in winter operation because altogether winter conditions require more unproductive work and lost time. Contractors generally assert that winter materials prices run lower. Here as in the case of labor there is a slack market and producers make price concessions to keep their products moving. Capital time value as it directly affects the contractor is chiefly saving in interest and depreciation charges on idle equipment.

Conclusion—Considering broadly the contractor's technical ability to perform work in winter the words of the Hoover committee offer an excellent conclusion as follows: "Summarizing the question of winter construction, it may be stated without fear of contradiction that both from an engineering and quality standpoint any type of modern building construction and most classes of engineering construction, can be accomplished, fully as well in the winter months as at other seasons, if the proper protection during the progress of certain parts of the work is provided. The increased cost of providing this protection, clearing away snow and ice, and all expenses incidental to such work, will vary from 5 per cent of the total cost of a building to something less than 1 per cent, depending on the severity of the winter and the size of the job, the relative expense being proportionately lower the larger the job."

[*The final article of the series will be on "Co-ordinate Services."*—EDITOR.]

Proposed Railroad Developments in Central Oregon

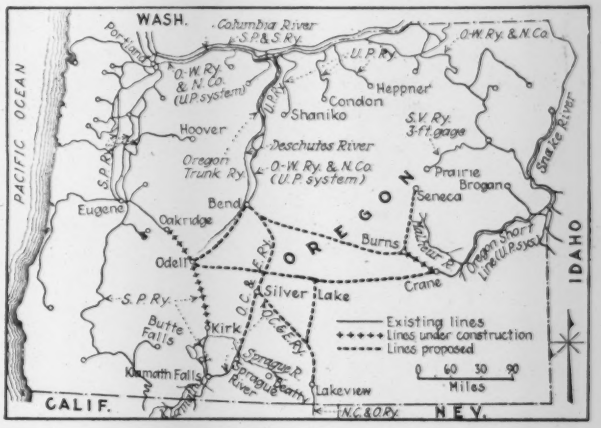
State Asks Interstate Commission to Require Companies to Build Extensions—Some Projects Now Under Way

THE FIELD for railway development in the central part of Oregon is being brought to attention by the action of the Oregon Public Service Commission in requesting the Interstate Commerce Commission to require certain railroads to build extensions aggregating about 400 miles in order to open up the country and also to provide more direct through routes. This district is a plateau about 3,000 ft. above sea level and made difficult of access by mountain ranges which flank it, including the Cascade Range of the Rocky Mountains along the west side. Besides great areas suitable for stock raising and agriculture, with and without irrigation, there are large timber and mineral resources. The Deschutes, Klamath and Malheur valleys afford more or less practicable routes from the north, south and east respectively.

In 1910 there was seen one of those picturesque but unfortunate and uneconomical phases of railway cut-throat competition when two rival and parallel lines were built simultaneously up the Deschutes River from the Columbia River valley by the Harriman and Hill interests, with the intention of developing a new district and forming direct north and south routes between California and the Northwest. These lines were the Deschutes Ry. (Harriman System), now owned by the Oregon-Washington Ry. & Navigation Co. (Union Pacific System), and the Oregon Trunk Ry. (Hill System), now a part of the Spokane, Portland & Seattle System. Extremely heavy construction was involved, as described in *Engineering News* of Aug. 11, 1910, p. 137. Both lines reached Bend, Ore., on the central plateau, about 150 miles from the Columbia, when financial and other difficulties led to the abandonment of further progress. Parts of the two lines are operated jointly by both.

The Oregon, California & Eastern Ry. is a more recent and independent project designed to open up the country for settlement and to complete the north and south artery by a line from Klamath Falls, on the Southern Pacific Ry., north to Bend, Ore., about 175 miles, with maximum grades of 1¼ per cent and curves of not more than 8 deg. This line has been completed to Sprague River, 40 miles, but as resources are limited the progress is slow. Proposed lateral extensions would connect the main route with Lakeview, for a second southern connection, and with Crane for a much needed eastern connection. This railway is practically a private enterprise in the hands of Robert Strahorn, president of the company; N. H. Bogue is chief engineer.

The Southern Pacific Ry. has a line extending from San Francisco into southern Oregon at Kirk, and is now pushing this line north 118 miles to Oakridge to connect with another existing Southern Pacific line and thus



RAILWAYS IN CENTRAL OREGON

form an alternative route between San Francisco and Portland. On the east, the Oregon Short Line extends up the Malheur River valley to Crane. From this point, the Herrick Lumber Co. is building a logging railway northwest to Burns and Seneca, and it has been suggested that this might be extended eventually to connect with one of the proposed north and south lines.

New railroads specifically requested in the application of the Oregon Public Service Commission were as follows: (1) Crane-Odell, (2) Bend-Odell, (3) Kirk-Odell, (4) Eugene-Odell, (5) Crane-Burns, (6) Lakeview to Klamath Falls or north to Odell. It will be seen from the map that railroads 3 and 4 will be provided by the new Southern Pacific line. As to elevations above sea level, the following may be noted: Columbia River (at mouth of the Deschutes River), 162 ft.; Bend, 3,600; Sprague River (at Beatty), 4,500; Klamath Falls, 4,100; Lakeview, 4,750; Crane, 4,150, and Silver Lake, 4,350 ft.

Highways have not been built into the central Oregon district to any large extent by the State Highway Commission, owing to the demand for improvements in the more populous parts of the state. Trunk line roads have been built to the borders of this district, however, and the general highway system as now laid out provides for main routes traversing it.

Data on Gravel-Road Corrugation—Its Causes

Loose Surface Material Kicked Back by Spin of Wheels—Plastic Material Flows Like Soft Bituminous Pavement

By George E. Ladd
Economic Geologist, U. S. Bureau of Public Roads, Washington

(Results of a study made by the Bureau of Public Roads in 1921 and published in its journal "Public Roads," September, 1924.)

WHAT is the nature of the rhythmic corrugations which occur in gravel roads in all parts of the country and which are a source of inconvenience if not an actual menace to traffic? How do they originate? Do they migrate or are they stationary? What is their relation to traffic? What relation have they to the kind of gravel used or the method of construction? What are the best maintenance methods with which to combat them? These and other similar questions have been investigated by the United States Bureau of Public Roads in the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New Jersey, Michigan, and Wisconsin. Detailed studies of gravel-road construction jobs were made in four states with the object

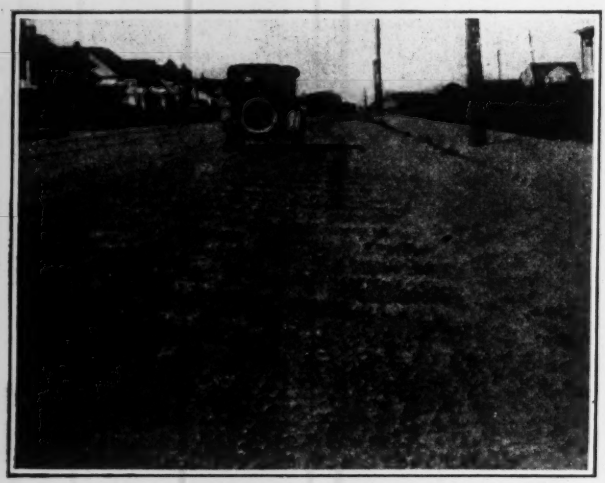


FIG. 1—CORRUGATION OF FREQUENTLY SPRINKLED ROAD

of keeping them under observation in the future. Gravels were sampled and tested, methods and costs of construction and maintenance were studied, and notes were made bearing on the traffic limitations of gravel roads.

Origin of Corrugations — Gravel-road corrugations are analogous in form to those occurring in bituminous roads, except that the former develop more uniformly and extensively. If not removed by maintenance they develop until each corrugation crosses the whole course of traffic and each series of them develops along the road until the next series is overtaken. The distance from crest to crest averages about 31 in., and crests are rarely found either less than 25 in. or more than 35 in. apart. Any considerable variation from the average appears to be confined to the area where one series as it develops along the road overtakes another. The maximum height from bottom of trough to top of crest is 1½ in. Any greater height than this was found in the field study to be associated with the beginning of pitting and raveling. These figures appear to be true of corrugations regardless of the nature of material in which they occur or the methods by which they develop. People traveling by automobile over roads so corrugated, not taking into consideration the speed at which they are passing over them, almost invariably estimate the distance from center to center of crest at 8 to 12 inches. A large number of highway engineers who have never given the problem special attention fall into the same error. The facts, however, as stated, were determined by observation on hundreds of miles of corrugated gravel roads in various states.

Inquiry among road builders as to the cause of gravel road corrugations resulted in the discovery of an amazing variety of explanations, some of which were very ingenious. The majority of replies erroneously attributed these corrugations to maintenance methods, particularly the use of the drag. The most ingenious explanation was offered by a man working on a corrugated road on the coast of New Jersey. He affirmed with positiveness that they are caused by the action of waves on an adjacent beach, transmitted to the road by earth vibration. As a matter of fact, these rhythmic corrugations develop in two ways, or through a combination of the two. They originate in vertical oscillations of rapidly moving automobiles, produced by obstacles, rough places in the road, or sharp depressions, and to this extent might in individual cases have their origin in an exaggerated case of poor dragging. They are, however, too widespread and too independent of dragging to justify in any general way their being attributed to this factor as a cause. Methods of their development which, it is repeated, may in some cases be combined, are as follows:

First Method—They are formed by the kick-back of surface materials arising from the spin of one or both of the rear wheels of automobiles as they descend after a bounce over some obstacle or depression. In Maine, where gravel roads are maintained by keeping a loose surface brushed over the road by means of scrapers, drags, and planers, corrugations were observed from their incipiency over a very extensive area. It was noted frequently that where cars bounded over obstacles or rough places in the road, a set of corrugations was started by the action of one rear wheel only. As the wheel descends with accelerated rotation it momentarily kicks back a portion of the loose material of the road surface. Spring action causes a second and third like phenomenon. As many as five of these mounds have been seen in sequence. By repetitions of this action elliptical mounds of loose material are formed the longer axes of which are at right-angles to the axis of the road. As traffic continues the action is transferred to the other rear wheel and a parallel set of these mounds is formed. The weaving in and out of cars rapidly connects the pairs of little mounds into a ridge and these ridges in time become continuous across the entire road. The shifting of cars about the center of the road evidently carries corrugations across it, so that they are picked up by traffic going in the opposite direction and they ultimately form a continuous series of crests and troughs extending from border to border. The writer has never seen two independent series on opposite sides of the road, where ridges do not coincide. It would appear, therefore, that they develop across the road faster than a series can multiply and advance along the road.

An interesting fact about their occurrence is that they are never found on steep hillsides. They may occur on the lower slopes or on broad tops, but they are not found either on the ascending or descending steep slopes. In ascending, the wheels cling to the road and in descending the cars coast. In neither case is there opportunity for the driving wheels to throw back surface materials.

Corrugations of this type are never well bonded and compact. After weeks of heavy traffic they may be scraped away by the hand.

Second Method—Whenever the clay bond in a gravel road is sufficient in quantity and has sufficient moisture to give the aggregate a certain plasticity, and especially where the gravel particles are well rounded, series of corrugations develop which correspond in measurements to those described above. Their origin, however, is different from that of corrugations of the class described above, in that they result from the squeezing of a plastic mass, and are produced in a way similar to the development of waves in improperly mixed bituminous roads. Such corrugations have been observed in northern states where glacial gravels are used, but there they are rather a result of a much too high original bond or the scraping of ditch dirt on the road. This type of corrugations may be best observed in New Jersey, especially on the Shore Road in and near Long Branch. Here the roads are built of highly water-worn gravel of small sized particles so rounded and polished that a clay binder, as low even as 10 per cent by weight, makes possible a plastic condition of the whole, especially when sufficient moisture is added.

The moisture on certain roads in question is furnished by daily sprinkling, in others by rainfall or by capillarity. Similar phenomena have been noted in roads built of cinders.

Rhythmic corrugations of this type result from impact, and, unlike the case of the first type discussed, the front and rear wheels of automobiles are equally active in their development.

Migration — Before the investigation was begun it was assumed that corrugations would slowly advance in the direction of traffic. Those, however, originating by the first method discussed appear to remain fixed where they originate. They are kept down in height by the action of wheels passing over them, and more especially by the limit of bound of cars, but they seem to move neither forward nor backward. At a number of places where they developed early in July reference stakes were driven on one side of the road, and they were kept under observation until late in the fall. No evidence of migration was noted. If corrugations move at all it would seem that they would at least swing on an axis located near the center of the road. This is exactly what happens with the impact type which originate in the more or less plastic varieties of gravel road. Many cases of this swinging on an axis were observed and photographed. This phenomenon is conspicuous where corrugations 6 or 8 ft. in length cross the center of the narrow roads of a semi-plastic nature.

In New Jersey an arrangement of corrugations was found which for a time was very puzzling. They were "herring-bone" corrugations. They approached the center of the road from both sides at an angle of about 60 deg. with its axis, making a series of V-shaped markings centering along the middle of the road. That these corrugations were originally at right angles to the axis of the road is evidenced by the fact that where the road is crossed by a concrete walk, a fixed obstacle, traffic had developed normal corrugations in its immediate vicinity on the take-off side but not on the approach side. At a distance of 12 or 15 ft. away, however, they became angular and assumed the positions described. In seeking a solution of this phenomenon the writer found conditions as follows: The road is 60 ft. in width with a very low crown. It is built of gravel consisting of very highly rounded and polished pebbles and sand and about 10 per cent of clay-silt bond. The road is sprinkled with water throughout the summer season to prevent dust. During the summer it is subject to traffic which rises on holidays to more than 10,000 cars a day. It is close to the shore and overlooks the surf, but automobile passengers are prevented from seeing the beach itself because of a broad boardwalk on the shore side. Considering the fact that here is a great bathing resort, and that the average automobilist enjoys the sight of surf bathing, it was assumed that, when traffic was not so excessive as to confine cars to double rows in both directions, there would be a drift of travel toward the shore side to get the view.

Traffic Density—Gravel road subject to a traffic of not more than 200 or 300 cars per day remains practically free from corrugations if occasionally dragged. As soon, however, as traffic reaches 400 to 450 cars per day, corrugations develop very rapidly. In the state of Maine, where tourist traffic is large during the summer months, and its rate of increase is well known, the state highway officials can predict almost to a day when corrugations will begin to develop on certain roads.

Material—The fact that these corrugations are so general and occur in all sections of the United States makes it evident that nearly all gravel roads, if they serve sufficient traffic, are subject to the development of this nuisance and menace, although the methods of construction and kinds of gravel vary widely. The situation, however, is not hopeless. Several highway officials have expressed the opinion that less corrugation trouble is found where the gravel is angular than where it is composed of highly rounded particles. It is also claimed that where the road is constructed of gravel more uniform in size than pit run, and especially where all particles over 1 in. in size are excluded, corrugations are slower in developing and more easily eliminated by maintenance methods. In northern New Hampshire some roads are built of so-called gravel which has resulted from the decomposition of granite rocks and is full of angular quartz. The roads built of this material are said to give better service so far as corrugations are concerned than those built in the same state of glacial gravels, or those resulting from disintegration of schistose rock. It is claimed in Wisconsin that the best service given by gravel roads, so far as corrugations are concerned, is found where pit-run gravel is passed through a crusher and only the material which ranges in size from 1 in. down is used. Highway engineers, notably some in Wisconsin and Oregon, object to any clay binder in the gravel and prefer only the fines produced by crushing and such as result from surface wear.

During the writer's investigations in Maine it was noted that roads with a relatively high percentage of clay-slit binder were comparatively free from corrugations. On one road on which rhythmic corrugations were well developed, a patch near the center of the road, about 70 ft. long and varying from 2 to 4 ft. in width, was uncrossed by corrugations and had a hard, smooth surface. Examination showed that this patch had about 5 per cent more clay-silt bond than the surrounding road.

On the gravel road between Waterville and Bangor, Me., corrugations develop rapidly during the summer traffic, and are kept down only by constant maintenance for almost its entire length. Comfortable travel on this road was made possible only by continuous use of drags and planers. One short section of the road, however, was practically free from corrugations throughout the summer. This section was built of a softer gravel which was high in clay-silt bond.

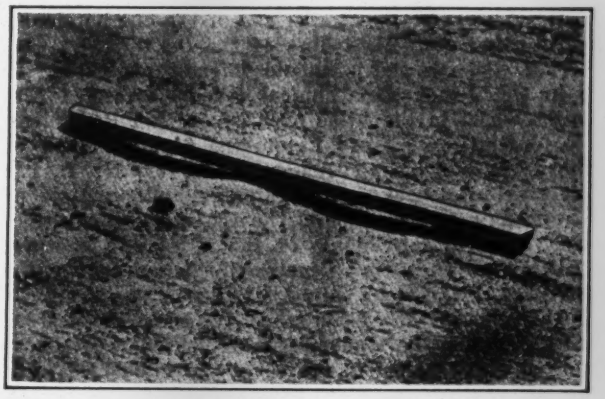


FIG. 2—WAVE FORM OF TYPICAL CORRUGATION

Unfortunately, however, while this section of road gives satisfaction during the summer months, it is said to be nearly impassible in the spring. Thus it may be that an all-year gravel road that will not require intensive maintenance can not be built in states subject to heavy freezing and wet seasons.

Surface binders in a general way prevent development of corrugations, and where these do occur on binder-treated roads it has been demonstrated that they result from excessive quantities of bituminous material. This statement does not refer to dust-prevention treatment, and is perhaps not true of lignin-treated roads. Some states use both tar and oil binders, some will use only oil, and others only tar. One state at least uses lignin almost exclusively. Dust preventives have been shown to fulfill the primary requirement. Their effect on corrugations, however, is not yet clear. They may delay but do not prevent the development of rhythmic corrugations of the first type discussed above. They also lengthen life of a road by saving surface material.

Maintenance—If traffic does not exceed 200 or 300 cars per day, occasional dragging, especially after rains, will keep the surface in good condition. As traffic increases, however, surface maintenance must be practically continuous, and even then dragging or scraping will not keep a road free from corrugations.

Apparently, the ideal machine for eliminating corrugations has not been devised. The planer certainly does not always entirely remove them, some of the bases of ridges being left, so that traffic may in 24 hours after the planing of the road reproduce the corrugations in original form and position. Even resurfacing with 1½ or 2 in. of gravel following planing of the road will not prevent the immediate recurrence of corrugations which have not been entirely eliminated by planing and dragging. In Wisconsin some gravel roads subject to heavy traffic are scarified once or twice a summer and left for traffic to recompact.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Engineering Education Ideals

A CHAPTER IN AMERICAN EDUCATION: Rensselaer Polytechnic Institute, 1824-1924—By Ray Palmer Baker, Professor of English in Rensselaer Polytechnic Institute. New York: Charles Scribner's Sons. Cloth; 5x8 in.; pp. 170. $1.

The history of Rensselaer Polytechnic Institute has been quite comprehensively covered by its present president, Dr. Palmer C. Ricketts, in a volume which has entered its second edition. Prof. Baker's book, or, as he modestly terms it himself, sketch, is not a history of that famous institution, but rather a commemorative tribute to its influence on American education and American life, a tribute published incidental to the celebration two weeks ago of the one hundredth anniversary of the founding of the Institute.

Prof. Baker's theme should interest engineers. It is in effect that the technical college, embodied first in the world in the ideas of Stephen Van Rensselaer, the founder, and Amos Eaton, the first president of Rensselaer Polytechnic Institute at Troy, N. Y., has left a definite mark on the thinking and practices of our changing civilization. The industrial renaissance which marked the middle of the nineteenth century, Prof. Baker shows, was materially forwarded by the activities of the technically trained men who came out of this pioneer technical school, a school formed in protest against the academic and classic view of education which prevailed in the early and middle years of the last century.

Prof. Baker's story of the development of the Institute is worth reading by every engineer and certainly by every engineering educator. The remainder of the book, a hasty though charming review of the individual successes among the alumni in the hundred years gone, has interest more specifically to those particularly concerned with the Institute, but nevertheless rounds out admirably the purpose of the book.

Mathematics Applied to Statistics

AN INTRODUCTION TO THE MATHEMATICAL ANALYSIS OF STATISTICS—By C. H. Forsyth, Assistant Professor of Mathematics, Dartmouth College. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 241. $2.25.

While most of the engineer's data are based on statistical material (including, of course, statistics of experimental results) the engineer is little acquainted with the mathematical machinery that has been applied to the study of statistical data. Such a presentation of this subject as is given in Prof. Forsyth's book will be found to be both "easy" and interesting. An unexpected feature of it is the introductory portion, dealing with the theory of finite differences and series, a subject which the engineer frequently encounters but which is not included in most college mathematical courses. The book is not directly written for engineering readers, and correspondingly it will be felt lacking in certain respects for this particular class, as also in the author's failure to accompany his analytical reasoning with the graphical analogues. However, every engineer with mathematical liking will find the book of value.

Ground-Water Engineering

REVIEWED BY JACOB FELD
Formerly Designing Engineer for Robinson & Steinman, New York City

DIE GRUNDWASSERABSENKUNG IN THEORIE UND PRAXIS—Von Dr.-Ing. Joachim Schultze, Privatdozent an der Technischen Hochschule zu Berlin. Berlin: Julius Springer. Paper; 7 x 10 in.; pp. 138; 76 line cuts. Price in Germany, paper, $1.45; bound, $1.70.

To obtain water where needed and to remove water where not desired, temporarily at least, is a problem confronting the engineer almost daily. A quantitative solution of this problem is ably described in this monograph by Dr. Schultze. The book is typical of the great majority of German technical books. It contains a complete historical summary of previous work, a detailed derivation of formulas, an enumeration of practical features of the problem and description of apparatus and equipment required for the job, a formulation of the application of the theory to design, a careful description of actual construction designed according to the method described; and it closes with the legal aspects of the problem and a bibliography. Financial considerations are emphasized, much more so than in the pre-war literature. Practically no mention is made of any but German apparatus and methods of construction; however, the results and conclusions obtained can easily be modified to apply to similar problems anywhere.

The problem resolves itself into two parts: The available water which may be obtained from wells, and the elimination of water from excavations by the temporary lowering of the water table, the latter filling practically the whole book.

The fundamental equations for the shape of the ground water table are derived for the case of a single well and multiple wells in ordinary soil conditions, between parallel flowing streams and in the midst of a body of water. These equations give the drop in the water surface at the well, and at any point outside, corresponding to any given constants and a uniform pumping of water. The time element from the beginning of pumping to the time of observation and the influence of rain are considered in detail. The results are illustrated by assumed data from which tables and graphs are computed to show the effect of the nature of the soil and the size and depth of the well. It is emphasized that the cost of the various sizes of wells controls the type to be chosen for a desired result. In considering multiple wells, it is shown that the formulas derived for a single well are applicable if the distance from the point under consideration to the single well is replaced by the geometric mean of the distances to the individual wells of any system.

A single well in unbounded territory influences an area which is a circle. Two wells operate over an elliptical area, which changes towards a lemniscate as the distance increases. A single well near an impervious wall is analyzed as if there were an "image" on the other side having a negative equal flow. This

case is very fully considered, for it is the one which usually occurs in excavations. Similar cases are then solved for wells within cofferdams.

Under design, descriptions are given of filters, pipes, well casings and pumps for small and large depths, together with their limitations and efficiencies. The type of power chosen and the disposal of the pumping water must take into consideration the general layout of the construction plant and the design of the structure.

Previous to any attempt at the application of the theory careful analysis of the soil is required, although the author states that a study of previously obtained experience and careful borings by an engineer will result in a much better estimate of the impermeability of the soil than elaborate laboratory tests. In outlining the method of design the various steps are considered in order: the depth and capacity of the wells, the type of filter, the type of pipe depending upon the nature of the ground water, the pump and power required. The method of field tests and the application of such experimental data are described; for small works, two or three borings are sufficient, but for larger excavations, 10 to 15 test wells should be driven.

The description of actual construction is divided into three parts: the building of subways and foundations by cofferdam methods in the midst of streams, similar locations where a watertight roof is built and tunneling methods are employed without the use of compressed air, and the excavation of foundations in water-bearing soils with and without the use of sheet-piling.

The Innselbrucke tunnel under the Spree, 9 m. wide and 125 m. long, was built in three stages, each consisting of a cofferdam kept dry by wells sunk 24 m. below water line, the water being about 4 m. deep and the subgrade 10.25 m. below water. A detailed description, including cross-sections showing the variation in water table with various pumping speeds, is given of this job. At the Jannowitzbrucke crossing of the same river, a concrete roof was built just below the river bed and tunneling operations were carried on practically in the dry. Several other locations where similar methods were employed are also described.

In ordinary foundations for buildings as well as for locks several interesting examples are given. The foundation for the ammonia works at Halle covered an area of almost 4,500 sq.ft. and was excavated in the dry by the use of wells spaced 35 ft. apart around the perimeter. The water table was lowered 7 ft. and no sheeting was required. The foundation for the Leipzig depot required excavation 16 ft. below ground water and the use of sheetpiles and wells about 25 ft. apart along the edges, averaging about 25 ft. in depth below subgrade, kept the water table a minimum of 4 ft. below subgrade. The specifications had required that no concrete be poured when the water table was higher than one meter below subgrade. Similar methods were used in building canal locks in Germany and Holland.

The book closes with a brief discussion of the question of legal right to alter the water table. The author cites several lawsuits which have occurred. In all, the book is a very detailed presentation of the subject, useful as a text as well as a reference book, and, in spite of the great detail, quite easy and interesting reading.

Turner Series Continued

ELASTICITY AND STRENGTH OF MATERIALS USED IN ENGINEERING CONSTRUCTION: Sections IV and V—By C. A. P. Turner, Consulting Engineer, M. Am. Soc. T. M., M. Am. Soc. C. E. Minneapolis, Minn.: The Author, Builders Exchange. Section IV: *Columns, Elastic Theory and Economic Design and Analysis of Eye Bars, Pin and Rivet Connections.* Cloth; 6x9 in.; pp. 134; 25 line cuts and halftones; structural tables. $5. Section V: *Economic Theory of Steel Railroad Bridge Design.* Cloth; 6x9 in.; pp. 129; halftones and structural drawings. $5.

The unconventional record of individual opinion on questions of mechanics and engineering which Mr. Turner began publishing some years ago has just been extended by two volumes of more direct interest to engineers than some of the preceding ones. In Section IV the author reviews at some length the subject of column strength and column formulas, besides dealing briefly with the stress distribution in eyebars and with the strength of pin and rivet connections. He holds in favor of harder column steel, harder rivets, and lower working stresses for rivets, and offers various other opinions of distinctly individual flavor. The chief part of the book, that reviewing various sets of tests on columns, will probably prove to be more useful in its references to the author's practical experience and observations than in its statements of theoretical kind. The latter not only show a certain bold unconcern for convention, but also are complicated by the fact that the author's style makes his text often decidedly hard reading. To quote two passages from the section on columns:

> The moment of inertia [in column action] is therefore four times as great as in simple flexure.
>
> Bending is thus induced by the equilibration of unbalanced shearing distortion instead of being substantially measured by the magnitude of the major plus and minus fiber elongations in parallel as in beam action.

Most readers will hesitate to accept these statements for the very good reason that they cannot tell what they mean.

In the second book, which impresses the reviewer as decidedly more interesting and valuable than the other, the same unfortunate complication of statement occurs. In this book it is quite evident that the author takes issue—and successfully—with many established traditions of bridge engineering. Such structures as his arch bridge for the Soo Line over the St. Croix River sufficiently testify both to his skill and to his discernment of good structural arrangement and proportion to give interest to his views on bridge design. But every page or two he becomes cryptic, not to say unintelligible. Thus, when he takes up the very warmly discussed subject of impact he screens himself behind a fog of words such as the following:

> The greatest elongation under tension, or deformation under compression, is a thermo-dynamic function such that the mechanical energy represented by the transfer of the kinetic heat energy of molecular vibration in the resisting metal to the potential energy of deformation of strain is double the external mechanical work of the load when the stress is tension, and the reverse when it is compression.

The reader, in short, gets only occasional glimpses of what the author has to say. These glimpses are sufficient, however, to make a reading of this book entertaining and enlightening.

The author presents and defends with considerable skill his belief in very long panel lengths, his advocacy of continuous stringers but his disbelief in the virtue of continuous trusses, his uncompromising hostility to sub-paneling and to eyebar construction, his claim that maximum stiffness and maximum economy are obtained

by the same proportions, and other interesting beliefs. The presentation of design drawings for several spans from 150 to 770 ft. long and his declamation against "doo dab lacing" and "nick nack triangulation" add to the stimulative value of the book.

The last chapter of the book is a lengthy discussion of various designs for the Sydney Harbor bridge, including a three-hinged arch design which the author prepared.

Planning and Building Steel Works

THE PLANNING, ERECTION AND OPERATION OF MODERN OPEN HEARTH STEEL WORKS—By Hubert Hermanns. London: Ernest Benn, Ltd. Cloth; 8 x 10 in.; pp. 307; 273 line cuts and halftones; bibliography. 42s.

The average civil engineer is inclined to look upon anything that has to do with a steel works as outside of his line, considering that his interest begins with the finished product except in so far as the results of his tests or practical experience may assist in improving the quality of the steel. Nevertheless there is a side which should have a peculiar appeal to him, the planning of the plant layout and the arrangements for the most expeditious handling of the heavy materials within the plant. These subjects, rarely dealt with in treatises on steel, are considered in detail in this book. It was written, originally, in German (now published in English as noted above) and although dealing largely with German steel works it nevertheless takes account of the better British and American plants. The relation of the steel works to other allied works is discussed as well as the location of the various departments within each plant, but the greater part of the book is given over to details of the equipment for a modern steel works. The closing chapters of the book are devoted to a discussion of efforts to improve thermal efficiency and of duplex and triplex processes.

Business Writing of Literary Quality

PRINCIPLES OF BUSINESS WRITING—By T. H. Bailey Whipple, Literary Critic, Westinghouse Electric and Manufacturing Co. East Pittsburgh: Westinghouse Technical Night School Press. Cloth; 6x10 in.; pp. 182.

It is a testimonial to the broader outlook of our modern engineering and industrial concern that the Westinghouse Electric & Manufacturing Co. should have an official known as a literary critic and second that it should be found worth-while to have that official prepare a book on the principles of business writing which is intended for the use of all the employees of the company who have anything in the way of composition to do. The effort seems well worthwhile, after reading Mr. Whipple's book. It is an excellent practical handbook for literary work, and, while it is directed mainly to the more work-a-day forms of literature, such as letters and reports, it will be found useful for any one who has writing to do.

PUBLICATIONS RECEIVED

WHILE THE LITERATURE ON THE DIVERSION OF WATER from Lake Michigan by the Chicago Drainage Canal is extremely voluminous, there are few places where a brief, succinct statement of the history of the case, its possibilities and its future is to be found. For that reason the recently issued report from the district engineer, United States Engineer Office, Chicago, is very valuable. The report is entitled "The Diversion of Water from Lake Michigan," with the sub-title "Report on the Sanitary District of Chicago With Recommendations for Action on the Part of the War Department With Reference to Diversion of Water from Lake Michigan," published by the Government Printing Office at Washington at the order or suggestion of the Chief of Engineers, United States Army.

IN CONTINUATION of the research publications of the Sewage Substation of the New Jersey Agricultural Experiment Station and State Department of Health the former has brought out a bulletin entitled A Bacteriological Study of a Sewage Disposal Plant, by William H. Gaub, Jr. (New Brunswick, N. J.). The studies were made at the joint sewage-works of Plainfield, North Plainfield and Dunellen, which comprise a Riensch-Wurl screen, Imhoff tanks, sludge-drying beds and sprinkling filters.

THE FARMER IS NOT being overlooked by the various state and federal government agencies of the country. An 18-p. pamphlet on Sewerage Systems for Farm Homes, with details of plumbing and of sewage treatment works, has been published by the Extension Service of the College of Agriculture, University of Wisconsin (Madison) in co-operation with State Board of Health.

A COMBINED LIST OF MEMBERS and directory of their products has been published as a booklet by The British Engineers' Association (32 Victoria St., Westminster, London, S. W. 1.), an organization of manufacturers.

WATER-WORKS OFFICIALS AND ENGINEERS who are familiar with the annual reports of Sir Alexander Houston, director of water examinations, Metropolitan Water Board, welcome each new report; being sure of additional research data, as well as of a summary of the year's sedimentation, chlorination and filtration operations. The report for 1923-24 follows the general lines of the earlier reports. (London: P. S. King & Son; 15s. in England.)

THE WISCONSIN STATE BOARD OF HEALTH has brought out a Waterworks, Sewerage and Refuse Disposal Code, giving its own regulatory provisions as to approval of plans, proper design and operation, etc., of the first two of these classes of works. The pamphlet also contains a table listing the municipalities of the state and showing their populations, sources of water supply and kind of purification, and also whether the places have sewerage and if so the method of treatment. These facts are summarized.

THERE IS NOW AVAILABLE the 1924 edition of the A.S.M.E. Boiler Construction Code, formulated by the Boiler Code Committee. New York City: American Society of Mechanical Engineers. Cloth; 6 x 8 in.; pp. 198. $2.50.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

BEACON LIGHTS OF SCIENCE: A Survey of Human Achievement from the Earliest Recorded Times—By Theo. F. Van Wagenen. New York: Thomas Y. Crowell Co. Cloth; 6 x 8 in.; pp. 444; 6 halftones. $3.

CONCRETE PRODUCTS: Their Manufacture and Use—Compiled, Written and Edited by Wallace R. Harris, Managing Editor, *Concrete Products;* President, Concrete Products Association; M. A. A. E., A. C. I., Society of American Military Engineers, Engineering Institute of Canada, Western Society of Engineers, Illinois Society of Engineers. [Second Edition]. Chicago: International Trade Press, Inc. Flexible; 5 x 7 in.; pp. 586; many halftones and line cuts.

FACTORY FLOOR SURFACES—By A. B. MacMillan, Chief Engineer, Aberthaw Co. Boston: Aberthaw Co. Boards; 6 x 9 in.; pp. 34; line sketches. $1.

FINANCIAL STATISTICS OF CITIES HAVING A POPULATION OF OVER 30,000, 1922—Compiled by Bureau of the Census, U. S. Department of Commerce. Washington, D. C.: Government Printing Office. Cloth; 6 x 10 in.; pp. 307; charts and tables. 75c.

MACHINE DRAWING PROBLEMS: A Text and Problem Book Involving a Study of Fundamental Elements of Machine Construction and Practice in the Conventional Representation of Machine Parts—By Edward Berg and George Wilson, Instructors in Mechanical Drawing, Milwaukee, Wis. Peoria, Ill.: The Manual Arts Press. Cloth; 8 x 6 in.; pp. 148; problem drawings. $1.60.

MANAGEMENT'S HANDBOOK—By a Staff of Specialists: L. P. Alford, M. E., Editor-in-Chief, Editor, *Management and Administration*, Vice-president, American Engineering Council. M. Am. Soc. M. E., M. National Association of Cost Accountants, formerly, Editor-in-Chief, *American Machinist*. Flexible leather; 5 x 8 in.; pp. 1,607; numerous charts and drawings. data tables. $7.50.

THOMAS ALVA EDISON: An Intimate Record—By Francis Arthur Jones. [Revised Edition.] New York: Thomas Y. Crowell Co. Cloth; 6 x 8 in.; pp. 399; illustrated. $5.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Traffic Through American Ports

Sir—In an editorial entitled "Los Angeles, the Second Port," which appears in your issue of Sept. 4, 1924, you credit Philadelphia, New Orleans, and Baltimore with holding, respectively, the third, fourth and fifth places in terms of total foreign and coastwise waterborne tonnage.

In so doing, you overlooked the possibility that one or more of the ports on which data were not yet at hand might have a higher tonnage than some of those on which data were furnished. This has proved to be the case. The 1923 figures for most of the principal ports are now at hand. I am enclosing a tabulation of the foreign, coastwise and other domestic tonnage, for all the larger ports.

You will note that, for foreign and coastwise tonnage only, both Boston and Norfolk exceed New Orleans and Baltimore. For all tonnage, Baltimore is fourth and Boston fifth.

The ten ports which you list cannot be taken as the first ten on a tonnage basis. Thus, Galveston, on your list, has a less tonnage than Seattle for foreign plus coastwise, and a less tonnage than either Seattle or Portland for all waterborne commerce. Other similar cases may be found when all figures have been checked and tabulated.

The introduction of Great Lakes ports would entirely change the relative standings. For example, Duluth-Superior had a total tonnage of over 59,000,000, exceeding any salt-water American port except New York.

For the Board of Engineers for Rivers and Harbors,
G. R. YOUNG,
Major, Corps of Engineers,
Resident Member of the Board.

Washington, D. C.,
Sept. 30, 1924.

TRAFFIC THROUGH CHIEF AMERICAN PORTS DURING YEAR 1923

(*Quantities expressed in short tons*)

Localities	Foreign		Domestic				
	Imports Tons	Exports Tons	Coastwise Receipts Tons	Coastwise Shipments Tons	Total Foreign and Coastwise Tons	Other Domestic Tons	Grand Total Tons
Baltimore, Md.	3,189,614	3,431,077	2,025,432	1,509,381	10,155,504	7,641,948	17,797,452
Boston, Mass.	3,031,479	481,961	10,091,095	1,613,128	15,217,663		15,217,663
Galveston, Tex.	1,744,365	1,444,114	807,047	1,350,676	5,346,202	417,603	5,763,805
Los Angeles, Calif.	452,228	2,534,402	4,343,349	19,824,571	27,154,550		27,154,550
New Orleans, La.	4,358,902	3,480,208	1,253,690	1,171,457	10,264,257	2,080,747	12,345,004
New York, N. Y.	10,481,786	10,174,880	18,271,371	9,861,816	48,789,953	68,326,122	117,116,075
Norfolk, Va.	383,906	1,796,870	841,574	9,274,939	12,297,289	1,723,829	14,021,118
Philadelphia, Pa.	4,458,138	2,975,288	4,596,661	3,200,362	15,230,449	11,820,219	27,050,668
Port Arthur, Tex.	1,497,379	1,404,723	158,069	6,116,525	9,176,696	577,324	9,754,020
San Francisco, Calif.	875,057	2,174,084	3,499,144	2,072,087	8,620,372	5,021,512	13,641,884

Shipping Board's Commerce Figures

Sir—With regard to your editorial on p. 366 of *Engineering News-Record* for Sept. 4, 1924, headed "Los Angeles, The Second Port":

I am informed that the Board of Engineers is taking up with you the misunderstanding with regard to the relative positions as expressed in your editorial. My concern therefore in writing this is to discuss that part of your editorial wherein it is stated in part "The Shipping Board *for some unknown reason* disregards all coastwise shipping except that which moves between the Pacific and Atlantic ports, taking no account of that considerable amount which moves between neighboring ports on the same ocean as between New Orleans and New York."

The finances at the command of the Shipping Board are limited, and the overseas figures and those between the Pacific and Atlantic ports are much more easily obtained than those between ports on the sea coast. In fact, the Shipping Board is largely dependent at the present time upon the customs districts for the figures which it compiles. The Board has, in fact, used the War Department's figures upon occasion, but the difficulty in this regard is usually that the Shipping Board desires its figures from month to month, whereas the War Department figures are only available annually. However, the Shipping Board and War Department are working together and have had under consideration for a considerable period this very subject of the collection of proper coastwise statistics. You may desire to explain this matter to your readers.

T. V. O'CONNOR,
Chairman, United States Shipping Board.

Washington, D. C.,
Oct. 8, 1924.

Hydraulic Notches for Channel Control

Sir—In the matter of the article printed in your issue of Aug. 7, 1924, p. 232, in which Mr. Muckleston advocates a "hydraulic notch" designed to maintain "normal" depth and velocity in a canal above a change of grade and section: That has been done in the Punjab and probably all other provinces of British India for twenty years or more.

The section of the notch is not curved, but a trapezium which maintains correct "normal" conditions at full and half supply depths; at intermediate depths the departure from "normal" due to not calculating more points for a curve, is less than the departures due to silting and scouring of the canal, and to difference between practice and calculations. Printed diagrams cover the range of conditions met with, including the range from a free fall to one nearly drowned; design is thus reduced to selecting the correct dimensions from these diagrams.

The sides of the masonry notch are formed to a standard curve, with the intention of securing a uniform coefficient of discharge. The base of the notch is extended as a semi-circular lip which spreads the discharge from the notch into a fan, improves the destruction of energy below the drop, and decreases action destructive to the channel below the fall.

Now even this trapezoidal notch is being susperseded by a rectangular notch. Our channels, dug in earth and carrying sandy muddy water, form their sections as trapezia with horizontal beds and ½:1 side-slopes; their discharges vary (both theoretically and practically) as the five-thirds power of the depth to quite small proportionate discharges: as the discharge of a proper rectangular notch varies as the three-halves power of the depth on its sill, it can be demonstrated simply that when the depth of the notch is 0.9 of the depth in the canal, the two discharge curves are tangential at that point, and away from it diverge less than matters practically.

The notches that are now being adopted are further built so as to avoid too sharp a dip of water-surface within the "control section," and too great departure from the parallelity of stream-lines assumed in arriving at the broad-crest formula

$$D = 3.09 \times w \times (d + h_a)^{1.5}$$

so that the notches form meters which do not need to be calibrated. This further insures that the discharge is independent of fluctuations of water-level downstream as long as the afflux is not less than ½ $(d + h_a)$. The fraction ½ can be halved or even further reduced, by providing a glacis and expanding section for recovery of kinetic energy.

Means for improving on the destruction of energy of the standard trapezoidal notch are also being explored.

Muree, Punjab, India. CUSEC.
Sept. 10, 1924.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

A City Manager "trained in engineering" is proposed for Bristol, Va.-Tenn. The council of that city recently voted, 3 to 2, to terminate the contract with its present manager for the purpose indicated.

Helsingfors and Twenty-Eight Other townships of Finland have just concluded a $7,000,000 loan from the National City Bank for civic improvements, according to cable advices to the Department of Commerce. It is understood that the rate of interest agreed upon is 6½ per cent. Bonds have been issued arranging for repayments to extend over a period of thirty years. The loan is guaranteed by the Finnish government.

Sixty-five Cities Throughout the United States and Canada will participate in Management Week which is to be held Oct. 20-25. Budgeting for better management is a subject which will be given wide discussion by engineers, manufacturers, educators, and economists. The events of the week are under the direction of the American Society of Mechanical Engineers, the American Management Association, the National Association of Cost Accountants, the Taylor Society and the Society of Industrial Engineers.

Contract Between the North Jersey District Water Supply Commission and some ten communities, including Newark, has been approved as to form by the commission. The authorities of each of the communities that propose to enter the district must sign the contract by Oct. 25. No such signature will be valid until a 30-day optional referendum period has elapsed, either without a referendum being called for or else with a referendum vote in favor of the contract. Any referendum would affect only the community in which it is demanded.

Continuation of Sanitation and road construction covered by contracts already existing between the Republic of Peru and the Foundation Co., of New York, is provided for in a $7,000,000 loan to the Republic of Peru arranged by the Foundation Co. through White, Weld & Co. and Blyth, Witter & Co. The loan has been under negotiation for some months. The bonds will be guaranteed by the Peruvian government and secured by certain governmental revenues which are to be collected by a collecting agency under the management of the Foundation Co. The present loan is part of a financing scheme involving a $25,000,000 contract between the Republic of Peru and The Foundation Co. covering road and street construction and the installation of modern water-works and sanitary systems in 32 of the principal cities.

Gorge Creek Plant Put in Service by City of Seattle

On Sept. 27 the Gorge Creek plant comprising the first unit of Seattle's municipal hydro-electric project on the Skagit River was officially put in service after several weeks of testing and preliminary tryout.

The present installation consists of two 37,500-hp. S. M. Smith vertical reaction turbines which for the present are operating at about two-thirds capacity under a head of 285 ft. pending the construction of a concrete diversion dam which is to increase the head by about 100 ft.

As the Skagit project stands today including construction railroad, Newhalem plant, north substation, Gorge plant, and the 100-mile, 165,000-volt transmission line, the total cost is stated to be $12,680,000, including interest during the construction period.

R. F. Walter Made Acting Chief Engineer of Reclamation Bureau

As a tribute to the very constructive work which he has done in his capacity as drainage engineer for the Reclamation Service, R. F. Walter has been appointed acting chief engineer for the Bureau of Reclamation. The assignment is an important one because the vacancy caused by the resignation of F. E. Weymouth may not be filled for some time in view of the possibility that fundamental reorganization may take place in the Bureau. Mr. Weymouth is spending this, his last month in the service, in visiting various projects with the idea of imparting to project managers some of his conclusions as to the general engineering policies which must be followed to secure the maximum of success for reclamation as a whole.

Mr. Walter has been in the Reclamation Bureau since 1903, having been first appointed engineer in charge of the construction of the Belle Fourche project; he held that position until 1909 when he was appointed supervising engineer. The following list includes the more important works constructed under his direction since that time: Pathfinder Dike, distribution system, third unit and Minatare Reservoir, North Platte project; East and West Canal systems, Selig Canal system, completion of Gunnison Tunnel and enlargement of Montrose and Delta Canal system, Uncompahgre Valley project; Grand River diversion dam and Canyon Canal and tunnels, Grand Valley project.

Prior to his entrance into the U. S. Reclamation Bureau Mr. Walter had had wide experience in irrigation practice as a consultant and as deputy state engineer of Colorado in charge of measurement of streams and canals.

Southwest Water-Works Men Meet at Topeka

Promulgate Filter Operators Schools and Take in Texas Section—Treatment Chief Topic

Engineering News-Record Staff Report

Eight papers referring to water treatment and three on other topics composed the technical program of the Southwest Water Works Association meeting at Tulsa, Okla., October 6-9. Plenty of time was given to discussions, a question box, entertainment, getting together and every morning an hour for viewing the exhibits put on by two dozen equipment companies. The exhibits were displayed in the meeting room, a fact which at least had the great advantage of insuring a full attendance at all meetings.

Financially, the association has had a good year, R. D. Morgan, secretary, reporting $375 in the treasury with no bills. Ten thousand pieces of mail have been sent out and the executive committee has taken over the Texas State Water Works Association with its Filter Operator's School as a section. Further, it is proposed to initiate such schools in each of the other seven states included in the territory of the association. The next school of two weeks' duration will be held at Austin, Tex., Jan. 26-31, 1925.

President Speaks

F. N. Lawton, in the president's address, stressed the responsibility of the superintendent in guarding the community's welfare against two great dangers—fires and epidemics. To conserve the consumer's welfare beyond question is the average citizen's conception of the operator's job in Mr. Lawton's opinion, but those in control of funds must be kept acquainted with the present and future needs of the system. A special point was made of beautifying the system and selling it through talks at civic meetings.

In a paper by Ernest Boyce, state sanitary engineer, Kansas, on "Co-operation and Importance of the Board of Health to Water Departments," the government's duty to prevent injury of the user was laid down as fundamental. A minimum of control but a maximum of co-operation is best in his opinion and should insure safety. Unfortunately, those who most need the help of the board come least often for assistance. Mr. Boyce distributed a new bulletin (July, 1924, Vol. XIII) on "Water and Sewage Laws, Rules and Regulations." By this bulletin, it is to be noted that the state board has ordered all cross-connections eliminated by July 1, 1925.

The Texas operator's school was described in detail in a paper by V. M. Ehlers, state sanitary engineer, Texas. Six schools of two weeks' duration have been held at cities having filters so

that practical demonstrations can be made. The function is to benefit the city, get the most out of the equipment and eventually to permit certified operators to hold their positions. A proposed bill, which has the support of the association, will require Texas operators to attend such a school annually.

In discussing the bill, Luke Ballard stated that the intent was to fix responsibility for the proper technical operation of plants. The difficulty now is that the mechanical man knows little of chemistry and bacteriology while the chemist is often equally ignorant of the mechanical operation. The certificate plan is to be self-supporting, contain a grandfather's clause, but insure his becoming efficient by the annual school attendance feature.

SPAVINAW PROJECT DESCRIBED

A. S. Holway described the Spavinaw water supply for Tulsa, Okla., stating that the last section of the 60-mile pipe line was now being placed in the Grand River Crossing which had proved to be the most troublesome section of work because of the numerous floods permitting less than two weeks work each in June, July and August. (Descriptions of this work appeared in *Engineering News-Record*, May 8, 816, and May 22, p. 899). Eight 100-ft. cofferdams made of timber cribs on the smooth limestone river bed carried on the upstream piers the locomotive crane to handle the excavation; concrete pipe laying and subsequent concrete backfilling will make a new smooth river bed. All other portions of the work are practically completed and an opening celebration is planned for November. Remarkably low leakage in testing the concrete line was reported, which fact will probably allow collection of a bonus, allowed in the bonus-and-penalty clause in the contract. Backfilling the 2-mile stretch of the Tiowa 7-ft. tunnel with concrete was accomplished by dropping the materials dry through 8-in. well holes spaced on 200-ft. centers and depositing the material with a pneumatic mixer.

Since the convention was at Topeka, the new softening and filter plant, described in *Engineering News-Record*, July 27, 1922, p. 153, was the subject of two papers. N. T. Veatch, of Black & Veatch, consulting engineers who designed and supervised construction, gave a general illustrated description, and A. L. Goggins, chemist in charge of operation, gave a demonstration at the plant of the chemistry involved and method of bacterial control.

Col. T. A. Leisen, general manager, Omaha Metropolitan Utilities District, presented an illustrated paper on the Detroit filters. R. E. McDonnell, consulting engineer, Kansas City, in his paper on "Modern Reservoir Construction" explained by means of moving pictures the method of constructing a circular concrete reservoir at Cedar Rapids, Ia.

Steps in the treatment of water by coagulation, sedimentation and filtration were outlined by Lewis I. Birdsall, consulting engineer, General Chemical Co. In discussion, Frank Bachman of the Dorr Co. indicated the place of the mechanical clarifier for heavy turbidities in such rivers as the Mississippi and Missouri.

James W. Ivy, American Cast Iron Pipe Co., in an illustrative paper described five recent improvements in cast-iron pipe manufacture: 1. Increase in length from 12 to 16 ft. 2. Long bells for gas pipe to make added tightness and reduce electrolysis. 3. Making of sizes smaller than 3 in. for services with bolted joints and bosses for tops. 4. Centrifugal cast pipe. 5. Bronze welding costing less than bell and spigot lead and jute joint. Mr. Ivy also contributed some practical ideas on methods of promoting a water-works system.

Chlorination was covered by Mr. Donsman who spoke on its advantages and by W. J. Orchard, of Wallace & Tiernan, who gave results. The use of lime in water treatment was described by L. B. Burt of the National Lime Association.

Entertainment consisted of dances at the new Hotel Kansan and on top of the pumping station, of a barbecue in the water-works park, of an inspection of the Santa Fe shops and a banquet tendered by the manufacturers' association.

The following officers were elected for the ensuing year: President, W. H. Anderson, Tulsa, Okla.; vice-president, Wilber Stanfield, Topeka, Kan.; secretary-treasurer, R. D. Morgan, Mexia, Texas.

Engineer Rifle Team Wins

The personnel of the Corps of Engineers and of the Reserve Corps are jubilant over the victory of the engineer team at the national rifle matches at Camp Perry. The victory is more remarkable since the Corps of Engineers entered a team for the first time at last year's match. To defeat the team of the Marine Corps, which has won the trophy for five successive years makes the feat a particularly notable one. In addition to the teams of the coast artillery, the infantry, the cavalry and the navy, the national guard of nearly every state competed. The high score on the Engineer team was made by Major C. L. Sturtevant, who made 285 hits out of a possible 300.

Chicago River Drawbridge Is Opposed

A project for a bascule bridge over the Chicago River at La Salle St. has been disapproved by Major R. L. Putnam, U. S. A., district engineer for the War Department, on the ground of serious interference with navigation, due to the proximity to other bridges, particularly the old center-pier swing bridge at Clark St., one block distant. This new bridge is proposed by the city to relieve traffic congestion, but Major Putnam considers that the Clark St. bridge be rebuilt first. Furthermore, he suggests that the city should decide upon its policy of fixed spans or drawbridges and the establishment of a lake-front harbor before it undertakes to build any more expensive drawbridges.

Consultants to Review Lake Level Problem

Chicago Sanitary District Calls in Commission of 25 to Pass on Position's Soundness

The Sanitary District of Chicago has called in twenty-five sanitary and hydraulic consulting engineers from every part of the United States to review in a broad way the solution of the problem its own engineers have worked on for thirty years. The commission of engineers began work Oct. 13, the problems being outlined by Edward J. Kelly, chief engineer, and George M. Wisner, consulting engineer. While the engineering talent of the district as well as all the data available will be at the disposal of the experts the commission was requested to effect its own organization and to produce such conclusions and recommendations as their investigations should warrant.

The members of the commission are as follows: C. E. Grunsky, San Francisco, Calif.; R. R. Lyman, Salt Lake City, Utah; John B. Hawley, Fort Worth, Texas; G. G. Earl, New Orleans, La.; Paul Norcross, Atlanta, Ga.; Col. J. L. Ludlow, Winston Salem, N. C.; Wynkoop Kiersted, Kansas City, Mo.; C. W. Hubbell and G. H. Fenkell, Detroit, Mich.; Arthur E. Morgan, Dayton, Ohio; Dean Anson Marston (Iowa State College), Ames, Iowa; Prof. S. M. Woodward (Iowa State University), Iowa City, Iowa; Morris Knowles, Pittsburgh, Pa.; J. F. Hasskarl, Philadelphia, Pa.; A. E. Phillips and Dr. F. H. Newell, Washington, D. C.; Prof. John H. Gregory (Johns Hopkins University), and Ezra B. Whitman, Baltimore, Md.; George W. Fuller, Frances Lee Stuart and James H. Fuertes, New York City; R. E. Horton, Albany, N. Y.; Dean E. E. Haskell (Cornell University), Hamburg, N. Y.; Harrison P. Eddy, Boston, Mass.; John R. Freeman, Providence, R. I.; T. Chalkley Hatton, Milwaukee, Wis.; Col. Charles S. Riché, and W. W. DeBerard, Chicago, Ill.

Raquette River Regulating Board Goes Out of Existence

The application of the Raquette River Regulating District for authority to function under the provisions of the conservation law of New York State, filed with the Water Control Commission on Aug. 28, 1922, was voluntarily withdrawn on Sept. 19 of this year. Due to the defeat of the Ferris amendment to the New York State constitution last year, which amendment provided for the use of a small amount of state lands for reservoirs, power-house sites, and rights-of-way for transmission lines, the usefulness of a regulating district for the Raquette River became of doubtful value because the construction of nearly all of the reservoirs required to control the flow of the Raquette River necessitated the flooding of small areas of state lands which are not available for that purpose under the present law.

Proposes Joint Committee on Reclamation

Dr. Mead Points Out Present Need for New Federal Attitude and State Co-operation

Washington Correspondence

Because of the very apparent need for working out an actual program covering the development of future reclamation, Dr. Elwood Mead, Federal Commissioner of Reclamation, believes the situation is of sufficient importance to warrant the setting up by Congress of a permanent joint committee to consider the matter. The problem is a very important one to the nation as a whole. Its scope is very wide and should include, Doctor Mead believes, a study of the disposition to be made of all the unused agricultural lands in the West. He regards it as highly essential that future development be planned long in advance.

It will require, Doctor Mead points out, an excess of $125,000,000 to complete the projects already approved. That means that this work will absorb the reclamation fund likely to become available during the next ten years. Development in the West, however, is so dependent upon agriculture that there is very great need for working out a plan which will be equitable to all of the states and at the same time remove uncertainties as to the course of future development. The matter of state contributions to the cost of projects, aside from that paid by the settlers, must be given consideration.

STATE INTEREST IN RECLAMATION

There is an increasing demand on the part of the states for a voice in matters concerning it so vitally as the character of the settlers who are incorporated into its population. The proposed committee to be drawn from each house of Congress, could confer with state authorities as to the fixing of their respective spheres of activity.

Doctor Mead also points out that the situation surrounding the unappropriated water which is available is a very complex one. He fears that serious conflicts cannot be avoided unless systematic utilization is mapped out in advance. The demand for water will become more intense as the population increases. There will be demands for water for purposes other than irrigation. There is every argument, Doctor Mead says, to prevent haphazard and wasteful development and this can be done only by fixing the location and the order of construction of new works for a long period in advance.

Another point which Doctor Mead emphasizes at every opportunity is the necessity for safeguarding future projects so that the enhancement of land values as a result of the expenditure of public funds is not absorbed by speculators. The safeguards necessary to meet that situation are confronted with difficulties, since future projects necessarily will be in areas where the land has passed into private ownership. On the projects already developed the public lands constituted less than one half of the project area.

Harbors Allotments Made

Additional allotments have been made from this year's $37,250,000 river and harbor appropriations, as follows: Sea-going hopper dredges, $300,000; Mississippi River, Ohio River to Missouri River, $300,000; Hudson River, $250,000; Chattahoochee, $145,000; Corpus Christi Channel, $750,000; Waccamaw River, $8,500; Nome Harbor, $5,000; Ashtabula Harbor, $7,000; Dunkirk Harbor, $4,500; Saginaw River, $17,000; Sacramento River, $85,000; Housatonic River, $4,000; Lakes dredge, $75,000; St. Clair River, $55,000; Santee River, $2,000; Beaufort Inlet, $500; pay roll, office Chief of Engineers, $110,500; Supervisor New York Harbor, $25,000.

Power Committee for New England States Appointed

As a further step toward the solution of the power problem for the industries of the New England States, the executive committee of the Associated Industries of Massachusetts has appointed the following standing power committee: Frederic C. Hood, chairman, Hood Rubber Co.; C. C. Chesney, General Electric Co.; Col. B. A. Franklin, Strathmore Paper Co. This committee will carry on the work of the power investigating committee whose report on the New England power situation was abstracted in *Engineering News-Record*, May 1, 1924, p. 770.

Highway Officials Will Discuss Federal Appropriations

One of the important matters which will be discussed at the tenth annual meeting of the American Association of State Highway Officials, to be held in San Francisco, Nov. 17-20, will be the legislative situation surrounding bills before congress. An effort will be made to get the full weight of the state highway commissions behind the appropriation bill, which carries the authorization for the funds for the program of the coming two fiscal years. The bill was passed by the House at the last session, but not in time to permit of its consideration in the upper chamber. It is recognized that there are difficulties to meet in a short session, when the appropriation bills must be considered along with such controverted matters as Muscle Shoals and reclamation policies. These two measures have precedence at the opening of Congress in December, and are certain to consume much of the time which could be given to legislation, other than the appropriation bills.

Fred R. White of Iowa will preside at the Monday sessions of the San Francisco metting. H. G. Shirley of Virginia will preside Tuesday morning; H. B. Philips of Florida will preside Tuesday afternoon and Mr. White again at the Wednesday sessions.

Arrangements have been made by the California Highway Commission to take all state highway officials attending from San Francisco to Los Angeles by automobile. The object is to give the visitors an opportunity to inspect road work along the route.

Highland Park Subway Planned for Traffic Relief

The construction of a subway through the Highland Park industrial district, Highland Park, Michigan, at the rear of the Ford Motor Co.'s plant, for a distance of approximately 1,800 ft., is planned. The subway is to be a part of a project for widening Oakland Avenue, in which both the city of Detroit and Highland Park will co-operate, Highland Park being a separate municipality surrounded by Detroit.

The work in Highland Park will include the grade separation subway from Ferris Ave. to Manchester Ave., thus eliminating traffic obstructions caused by the Detroit Terminal Ry. and Ford industrial railway crossings. This plan is designed to help relieve congestion of traffic on Woodward Ave. The plan calls for almost total depression of the street under the tracks, the subway and approaches approximating one-half mile in length.

The Detroit City Plan Commission is co-operating with the Highland Park engineers; the Ford Motor Co. will share largely in the cost of the project. Lawrence C. Whitsit is city engineer of Highland Park.

Organization Complete for Cement Research

About a year ago, the Portland Cement Association began making plans for a thorough research into the composition, properties, behavior, etc., of cement. It was found difficult to secure men with the right experience and qualifications.

After much painstaking effort, however, a competent staff has been recruited and is at work under the Portland Cement Fellowship at the Bureau of Standards, Washington. The whole investigation is under the general direction of Dr. P. H. Bates, of the Bureau. Three of the research men have been detailed to the work by the Portland Cement Association, while the Bureau of Standards supplies one man on full time and a number on part time.

The Portland Cement Association representatives are Dr. R. H. Bogue, formerly professor of physical chemistry, Lafayette College, Easton, Pa., and author of "Colloidal Behavior"; F. W. Ashton, petrographer and Dr. W. C. Hansen, colloidal chemist. The principal Bureau of Standards representative is Dr. L. S. Wells, physical chemist. The initial investigations include a study of hydration in all its phases; of clinker made first from pure compounds and then with admixture of impurities found in natural materials; and, third, petrographic studies to determine the characteristics of materials and the reactions that take place in the making of concrete.

Further studies will be taken in hand as their desirability is developed in the first three researches. To date, much time has been spent in developing technique, particularly in the petrographic studies. The work is now actively in hand in all three lines.

A. E. C. Board Will Meet in Chicago Oct. 17 and 18

Plans of the engineering profession toaid in the reorganization of the executive department of the government will be discussed at a meeting of the administrative board of the American Engineering Council at Chicago, Oct. 17 and 18. The bill reported by the joint committee on the reorganization of the executive departments, according to word from the council, only partially meets the wishes of the engineers, who originally sponsored the movement for the establishment of a Department of Public Works.

Engineering activity in the direction of co-ordinating the public works and construction functions of the government was revived at a conference in Washington some time ago of more than fifty organizations under the auspices of the Council. Definite recommendations, continuing the movement, will be presented to the Chicago meeting.

National fuel conditions will be another topic of the Chicago gathering, a committee of the Council having recently completed a nationwide survey of the coal storage situation. The committee's report, comprising about 100,000 words, will be given out following the meeting.

Airmail and commercial flying, cooperation by national conference on out-door recreation, needs of the U. S. Patent Office, standard contract forms as developed by a joint conference committee, the World Power Conference in London, the International Management Conference at Prague, and the Third Pan-American Scientific Congress are other subjects to come up.

Court Issues Injunction in Asphalt Paving Suit, St. Louis

The United States District Court in St. Louis, Mo., Oct. 4 issued an injunction against the Trinidad Asphalt Manufacturing Co., St. Louis, restraining that company from infringing on the patent rights of the Western Willite Co., which manufactures asphalt hardened by a mixture of copper sulphate, the formula being patented. The Trinidad company contends that the formula is not patentable. Judge Faris, in granting the injunction, pointed out that the validity of the patent was not in question, but that the evidence led him to believe that the use of copper sulphate with a finely divided filler is novel and a forward step in roadmaking.

Iowa To Study Engineering Ethics

Study of the ethics and practice in the field of civil engineering will be part of a recently-established course in business and professional ethics given by the department of philosophy and psychology of the University of Iowa. The university is co-operating with the American Association of Engineers in giving the engineering phases of the course. Arrangements are also being made to co-operate with professional organizations in medicine, law, and business.

Hetch Hetchy Bond Issue of $10,000,000 Approved

At a special election held Oct. 7 the voters of San Francisco by a majority of about 20 to 1 approved a $10,000,000 bond issue to defray the cost of further construction on the Hetch Hetchy water project. Of this amount $8,000,000 is to cover the cost of driving the 17-mile tunnel from Moccasin Creek into the San Joaquin Valley, and $2,000,000 is to be used for shafts and other preliminary work on the 31-mile tunnel yet to be driven through the Coast Range Mountains separating the San Joaquin Valley from San Francisco Bay. A previous announcement concerning this bond issue was published in *Engineering News-Record*, Sept. 11, p. 440.

Winnipeg Flow Control Settled

Control of the flow of the Winnipeg River, in Canada is to be vested in a board representing the federal and provincial governments, according to an agreement between the Canadian government and E. W. Backus, pulp and paper manufacturer of Minneapolis, owner of the Norman Dam on the Lake of the Woods. The need for the reconstruction of the dam and enlarging the outlet has recently resulted in a demand to have the control of the flow of the river taken out of the hands of private interests. Enlarging the outlet is to be undertaken by the government in order to fulfill its undertaking with the state of Minnesota to prevent the annual flooding of Minnesota land on account of the restricted outlet to the Lake of the Woods.

Break in New Reservoir Ascribed to Faulty Construction

The Garfield Avenue reservoir, an earth embankment structure with a concrete lining, built for the city of South Pasadena, Calif., and which was filled for the first time on Aug. 30, gave way at 3 a.m. on Aug. 31, sweeping away gardens and damaging residences in the path of the released flood. The reservoir was built under contract and had not been accepted by the city, pending an inspection for leaks which was to be made 24 hours after the first filling.

The plans called for a minimum width of 9 ft. at the top of the embankments on which the concrete lining was supported, but at the point where the break occurred the top width was 24 ft. and the width at a depth of 12 ft. was 46 ft. On the other hand, the wire-mesh reinforcing supposed to be embedded in the lining was at this point found to be on the lower side of the slab and almost out of the concrete.

After the break the city appointed a consulting board of engineers to investigate the failure, consisting of Harry Hawgood, chairman, Stanley Bent and George Sidney Binckley. The findings of this board were:

"(1) That the failure of the Garfield Avenue Reservoir was the result of improper and defective construction. The embankment was not constructed in accordance with the requirements of the specifications.

"(2) That the ground upon which the reservoir embankment was constructed was not properly prepared for the bonding of the embankment material with the underlying natural material in place.

"(3) That the concrete lining where the break took place, was deficient in strength, due to failure to properly place reinforcing material in conformity with the specifications."

SECTION OF BREAK IN RESERVOIR AT SOUTH PASADENA

Embankment on which the concrete lining was supported at this point was 46 ft. thick, 12 ft. below the top. Note mesh reinforcing out of place on under side of slab.

Reserve Corps Officers Named

The Corps of Engineers has made public a list of appointments and promotions in the Reserve Corps. The list follows:

APPOINTMENTS

Colonel—Lorimer D. Miller, Philadelphia, Pa.

Lieutenant-Colonel—Jefferson D. Davis, Fort Miller, N. Y.

Major—Albert E. Allen, Florence, Ala.; William M. Baxter, Chicago, Ill.; Henry L. Freeman, Birmingham, Ala.; William D. Gilkinson, Dallas, Texas; John A. Hunter, Toledo, Ohio; Sidney E. Kelsey, Lexington, Mo.; Roger B. McWhorter, Florence, Ala.; Richard O'Leary, El Paso, Texas; Henry O. Valeur, Muskogee, Okla.; John M. Walsh, Memphis, Tenn.; John L. White, Lecompte, La.

Captain—Irving Anderson, Marceline, Mo.; Benjamin F. Bilsland, Wilmette, Ill.; Louis S. Bruner, Philadelphia, Pa.; Otto H. Coppock, Idabel, Okla.; Llewellyn G. Couter, South Bend, Ind.; Forrest R. Doud, Chicago, Ill.; Frank D. Duff, Moore Haven, Fla.; Albert J. Duncan, Greenfield, Mass.; Howard Duryea, Birmingham, Ala.; John Edwards, Keyser, W. Va.; Walter C. Eells, Walla Walla, Wash.; John E. Feathers, Akron, Ohio; William F. Gettelman, Bismark, N. D.; David J. Gothold, Detroit, Mich.; Clark M. Groninger, Akron, Ohio; James J. Hansen, Omaha, Neb.; Murray D. Hetherington, Chicago, Ill.; Harold A. Hobson, Canton, Ohio; Andrew R. Jurden, Kansas City, Mo.; Ernest Kitchen, St. Petersburg Fla.; Harold D. LeMar, Rapid City, S. D.; James P. Lewis, Birmingham, Ala.; Robert N. McKitterick, Emporia, Kan.; Jameson Marshall, Yonkers, N. Y.; Louis Moon, Buffalo, N. Y.; Howard A. Olds, San Francisco, Calif.; Harry W. Powers, Pittsburgh, Pa.; Floyd L. Reed, Paulding, Ohio; Harry A. Roberts, Portland, Ore.; Edward A. Schaaf, Chicago, Ill.; Herbert E. Schmidt, Nashwauk, Minn.; John A. Sheedy, Canton, Ohio; Robert W. Smith, Columbus, Ga.; Samuel L. Smith, Washington, D. C.; Thomas M. Spence, Lafayette, La.; Clyde M. Trussell, Akron, Ohio; Sylvester F. Wilson, East St. Louis, Ill.

PROMOTIONS

Lieutenant-Colonel—Frank C. French, Milwaukee, Wis.; Percy F. Goodwin, Portland, Me.; Dana Q. McComb, Los Angeles, Calif.; Otis M. Page, Newberry, S. C.; Walter K. Quigley, New Haven, Conn.; William J. Shea, Brooklyn, N. Y.

Major—Lawrence B. Ackerman, Savannah, Ga.; William C. Buhmann, Charleston, S. C.; Moses E. Cox, Gray Court, S. C.; William P. Danford, Oklahoma City, Okla.; George C. Greater, St. Louis, Mo.; Frank L. Gray, Gary, Ind.; William E. Haberlaw, Bureau, Ill.; Neil S. Kingsley, Minneapolis, Minn.; Frank A. McComber, Duluth, Minn.; Samuel McKirahan, Rapid City, S. D.; Alfred I. Matthew, Tacoma, Wash.; George W. Summers, Augusta, Ga.

Captain—George A. Almes, Las Vegas, N. M.; Joseph R. Avinger, Birmingham, Ala.; Hugh H. Bennett, Wadesboro, N. C.; Floyd L. Boardman, Seattle, Wash.; Fred Cobb, Norman, Okla.; Donald M. Cook, Grand Rapids, Mich.; George L. Cook, Wetumka, Okla.; Richard C. Dugdale, Hailey, Idaho; Lewis J. Edmunds, Somerville, Mass.; Charles G. Frost, Lynn, Mass.; Harold L. Hock, San Francisco, Calif.; Fred W. Householder, Essex Junction, Vt.; Charles J. Lawson, Flint, Mich.; Neil M. MacNeill, Woodrow, Colo.; Benjamin H. Martin, Sterling, Colo.; James C. Othur, Corvallis, Ore.; John I. Quinn, Washington, D. C.; Wilford A. Thompson, St. Louis, Ill.; Samuel B. Schenck, Pittsburgh, Pa.

Baltimore Plans Centralization of Engineering Services

A charter amendment authorizing the centralization of the engineering services of the city of Baltimore, Md., in a single department will be submitted to popular vote on Nov. 4. The amendment is in line with the recommendations of the commission on economy and efficiency noted in our issue of Aug. 28, p. 358.

High Head Power Plant Is Completed

Early in October construction was practically completed and final tests were being made on the Leevining Creek No. 1 hydro-electric project of the Southern Sierras Power Co. This plant is located in the Sierra Nevada mountains in central California at an elevation of 8,000 ft. and draws its water supply from reservoirs well above the 9,000-ft. elevation. The natural reservoir from which the supply is taken directly is Saddlebags Lake whose capacity has been increased to 10,000 acre-ft. by a 30-ft. rock fill dam with timber face. The static head on the plant is 1,675 ft. which is developed in a single penstock varying from 48 in. in diameter at the upper end to 24 in. at the power house. For about half a mile at the upper end the penstock in the form of a riveted steel line passes through a tunnel after which the slope becomes steep and lap welded pipe is thereafter employed.

The plant contains a single 10,000-kva. generating unit mounted on the shaft of a 14,000-hp. single overhung impulse wheel. This wheel is one of the largest units ever equipped with a deflector of the sleeve type for controlling speed.

The current is delivered over a 110,000-volt wood pole transmission line to the company's power line at Rush Creek, 22 miles away, whence the transmission system continues into Southern California.

Chicago Lumber Dealers Accused of Restricting Competition

The Chicago Retail Lumber Dealers Association, its officers and members, are named as respondents in a complaint issued by the Federal Trade Commission charging unfair methods of competition. The members of the respondent association include most of the large lumber dealers of Chicago, and according to the citation such members sell approximately three-fourths of all the lumber sold within the territory in which they operate.

The complaint states that the respondents entered into a combination and conspiracy to restrict competition with the effect of increasing the prices at which lumber and other building material should be sold. In order to carry out its purpose, the complaint alleges, the respondents, operating through the Chicago Retail Lumber Dealers' Association, adopted a plan which the complaint terms an "allotment pool." The object of such pool, the citation continues, was to prorate and divide in advance the aggregate annual business of the respondent members on the basis of certain fixed and agreed upon percentages.

The complaint further states that in carrying out its "allotment pool" plan respondents have removed and destroyed the right of the purchasing public to deal in a freely competitive market and to secure lumber and building material based upon such a competitive market.

Random Lines

Oh! Well! the Idea Is Still a Good One.

From an Address by Charles Whiting Baker, Editor of *Engineering News*, March 24, 1909, before the "Conservation" Meeting of the National Engineering Societies.

Suppose it were possible to bring the buildings which were visited by fire in 1907 all together and to range them on both sides of a long city street. We will assume that the lots on which these buildings stand have an average frontage of 65 ft. This street, lined on both sides with the buildings visited by fire in 1907, would reach all the way from New York to Chicago. Picture to yourself driving along this terribly desolated street. At every thousand feet you pass the ruins of a building from which an injured person was rescued. Every three-quarters of a mile there is the blackened wreck of a house in which some one was burned to death. Suppose the fire starts at one end of the street on the first day of January and is steadily driven forward by a high wind, just as actually happens in a conflagration. The fire steadily eats its way forward at the rate of nearly three miles a day, for a whole week, for a whole month, for all the twelve months of the year. And at the end of 1907 did the conflagration end? No; it began on a new street a thousand miles long which was likewise destroyed when 1908 was ended.

From a Talk Broadcast over WEAF, Oct. 9, 1924, by I. G. Hoagland, Fire Prevention Engineer.

The big smoke of 1923 was at the rate of a dollar bill every eleven weeks for everyone in the whole population. The staggering total was 508 million dollars, but that was not the total of all of the dollars that vanished. To get an idea of what this means, picture a turnpike-road running from New York to Denver, 2,000 miles long, and on both sides of this road, on lots with an average frontage of 50 ft., the different kinds of buildings that make up a city: dwelling- and school-houses, churches, institutions of mercy, office and public buildings, theaters, hotels, stores, factories, mills, warehouses and so forth, all of which were ravaged by fire last year. Suppose we take a drive along this terrible turnpike following in the wake of the fire that started at New York in January, 1923, and burned through on both sides of the way clear to Denver by the end of the year. One after another we pass buildings more or less wrecked according to how much could be done by our human fireman to fight the onward rush of the flames. Every eighth of a mile we pass a fire-wrecked building in which someone was burned to death and another in which a person was injured.

* * *

Some Chaser

A Cleveland correspondent thinks the accompanying newspaper account of the glorified "devil-chaser" belongs in Random Lines. The reporter wrote:

"An oxygen tank, made wild by gas escaping from its valve, skipped back and forth across the intersection of Euclid avenue and E. 4th St. yesterday afternoon in the rush hour and tied up traffic. The tank bounced out of a truck and began to cut figure eights, shooting in and out among the crowd and automobiles. It hit a white way pole and bent it, drove dozens to execute running broad jumps, and finally hit two persons, who tried hard to get out of its way. It came to rest, empty, under the wheels of an automobile."

Income of Ontario Hydro

Gross income for the Ontario hydro-electric system for the ten months ending August 31 is given as $10,894,580 by Sir Adam Beck, chairman of the Ontario Hydro-Electric Commission. The expenses, including allowance for sinking fund, amounted to $10,677,880, leaving a net surplus of $216,700.

Engineering Societies

Calendar

Annual Meetings

AMERICAN PUBLIC HEALTH ASSOCIATION, New York City; Annual Meeting, Detroit, Mich., Oct. 20-23, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Fall Meeting, Detroit, Mich., Oct. 23-25, 1924.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, D. C.; Annual Convention, San Francisco, Calif., Nov. 17-20, 1924.

ADVISORY BOARD ON HIGHWAY RESEARCH, Washington, D. C.; Annual Meeting, Washington, Dec. 4, 5.

AMERICAN ROAD BUILDERS ASSOCIATION, New York City; Annual Convention, Chicago, Ill., Jan. 5-9, 1925.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 27-29, 1925.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 24-27, 1925.

A Georgia Chapter of the Associated General Contractors has been organized. Officers elected for the coming year are: Otis Barge of the Barge-Thompson Co., president; A. J. Krebs, of the Krebs Construction Co., vice-president; Sam W. Hodges, of the Griffin-Hodges Co., treasurer; and C. D. Crockett, of the A. K. Adams Co., secretary, all of the general contractors' section. For the highway construction section the officers are: F. A. Pittman, of the Pittman Construction Co., president; H. L. Jamieson, of the Jamieson-Hallowell Co., secretary-treasurer.

The North Carolina Section of the American Water Works Association will hold its annual convention in Charlotte the tentative dates being Nov. 11-13.

The Duluth, Minn., Engineers' Club will have as the special feature of its monthly meeting, Oct. 20, a talk by Dennison Fairchild, supervisor of bridges and buildings, at Duluth, of the Northern Pacific Ry., on the reconstruction and improvements of the Duluth union depot.

The Providence, R. I., Engineering Society opened its season Sept. 30 with a smoker and a general good time.

The National Association of Railroad and Utilities Commissioners will hold its annual convention at Phoenix, Ariz., Nov. 11 to 14, 1924. It is expected that there will be addresses by Secretary of Commerce Hoover and by representatives of important railroads, and gas, electric and telephone companies. The main topics for discussion will be grade crossing elimination, regulation of motor vehicle transportation, rates of railroads and public utility companies, railroad valuation, uniform laws for the regulating commissions, and proposed amendments to the federal Transportation Act of 1920.

The Brooklyn Engineers' Club will have for its October meetings the following special features: Oct. 9, a moving picture showing the development of steam power from the earliest forms to the modern turbine generating units, shown by Albert A. Northrop, of Stone & Webster, Inc.; and Oct. 23, a talk on mathematical history, by R. C. Strachan, club member.

Personal Notes

J. A. LEONARD, formerly designing and construction engineer of the Central Maine Power Co., Augusta, Me., has been appointed hydraulic engineer of the Bangor Railway & Electric Co., with headquarters in Bangor, Me.

H. HOBART PORTER, of New York City, has been elected to the Board of Trustees of Columbia University, succeeding Dr. Walter B. James, whose term has expired. Mr. Porter, who graduated from the engineering school of Columbia University in 1886 with the degree of M. E., is associated with numerous business enterprises, largely public utilities. He is president of the American Waterworks and Electric Co. and of the Brooklyn City Railroad Co., and a member of the firm of Sanderson & Porter of New York City. Mr. Porter is a member of the executive committees of the National Research Council and of the Engineering Foundation. He is a director of the National Surety Co. and of several public utility and railway companies.

L. E. TUCKER is president and FRANK C. BOES is vice-president of the Tucker Construction Co., which is the new name of the firm formerly standing as Tucker & Lewis, Inc., general contractors. The headquarters of the company will remain at 103 Park Ave., New York City.

FRED L. HICKS, formerly with the Kentucky State Roads Department but recently with the Alabama State Highway Department, has again become connected with the Kentucky department.

ARTHUR H. BLANCHARD, professor of highway engineering and highway transport of the University of Michigan, has been appointed consulting engineer to the Michigan State Highway Department.

GEORGE F. NICHOLSON, chief engineer and executive secretary of the port of Seattle, Wash., together with Major Charles T. Leeds, of Leeds & Barnard, consulting engineers, Los Angeles, Calif., have been retained by the Chamber of Commerce of Richmond, Calif., to make a survey and report of the harbor development and industrial situation of the port of Richmond, San Francisco Bay. This survey will start about Oct. 15. G. B. Hegardt, of the port of Portland (Oregon), commission, is a third member of the consulting board.

RAYMOND WITT has been appointed city engineer of Chico, Calif., succeeding Charles M. Ennis, resigned. Mr. Witt has been with the city engineering department of Chico for the past six years, having served in that department under Martin C. Polk and Frank S. Robinson.

EDWARD HYATT, JR., has been appointed chief of the California State Division of Water Rights, State Department of Public Works, upon the recommendation of State Engineer W. F. McClure. Mr. Hyatt has been acting chief of the division since the resignation of H. H. Kluegel last February.

WILLIAM E. ROW of Los Angeles has been appointed an assistant engineer on the California State Railroad Commission. Mr. Row served a number of years in the engineering department of the Southern California Edison Co., followed by four years in China as construction engineer for the Forbes Co., Ltd., of Shanghai. Upon his return to this country he again entered the service of the Edison company.

FRED A. LORENTZ has terminated his connection with the Los Angeles Board of Public Utilities as chief engineer. His resignation was tendered some time ago but at the request of the board he remained on the job up to the present time. President E. F. Bogardus will temporarily perform the duties of chief engineer.

GENERAL GEORGE W. GOETHALS has been retained by the Los Angeles County Flood Control District as consulting engineer of the dams and other appurtenances to be carried out under the $35,000,000 bond issue. Mr. Goethals is now engaged in making a personal survey of the locations of the various projects in company with J. W. Reagan, chief engineer of the district.

Obituary

JOHN H. CARPENTER, well-known civil engineer of Westchester County, New York, who had held many offices in past years in White Plains, N. Y., died in that city last week, aged seventy-three years.

CHARLES F. NOLAN, contractor and builder, of College Point, Queens, New York City, dropped dead recently in an office in the Municipal Building, Long Island City. Mr. Nolan years ago was a first-class engineer in the United States Navy and served with Admiral Dewey at Manila Bay. Later for several years he was an engineer with the Queens water department.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Wants Steel Rails and Bridges

It is reported to the U. S. Department of Commerce by the commercial attaché at Peking that the South Manchurian Ry. is in the market for 7,000 steel rails and that the Peking-Hankow Ry. will purchase 24 steel bridges of from 10 to 40-m. span.

Water-Works Equipment Companies Exhibit at Topeka

At the Southwest Water Works Association meeting Oct. 6, 7, 8 and 9 at Topeka, Kans., twenty-four water-works equipment companies exhibited their products. No large machines were shown as the small exhibit room was used for meetings; an hour of the program period specifically was set apart to enable members to meet the equipment men. The plan worked well for both parties, and the meetings always were attended by a large number of members.

The following is a list of the exhibitors: Pittsburgh Meter Co.; Leadite Co.; The Rothrock Co.; National Meter Co.; Dallas Foundry; National Cast Iron Pipe Co.; National Water Main Cleaning Co.; Neptune Meter Co.; Pitometer Co.; Thomson Meter Co.; Ford Meter Box Co.; Hersey Manufacturing Co.; South West Meter Box Co.; R. D. Wood & Co.; Worthington Pump & Machinery Co.; Sullivan Machinery Co.; Rensselaer Valve Co.; Badger Meter Co.; Birch Manufacturing Co.; Columbia Iron Works; McWane Cast Iron Pipe Co.; Mueller Manufacturing Co.; Wallace & Tiernan Co.; H. W. Clark Co.

Would Reduce Conductor Pipe and Eaves Trough Sizes

Elimination of two sizes of plain round conductor pipe sizes out of eight made at present, and of three of the eight sizes of eaves trough, as well as one size of conductor pipe elbow, is recommended by the Simplification Committee of the eaves trough and conductor pipe industry, which has been working with the co-operation of the Division of Simplified Practice, Department of Commerce, toward a reduction of waste in the industry. The Simplification Committee is headed by A. Q. Moffatt of the Wheeling Corrugating Co., Wheeling, W. Va., with George A. Fernley as secretary. The simplification was undertaken as a result of a meeting of the Metal Branch of the National Hardware Association of the United States, held in Cleveland in May, 1923, since which time surveys have been made and a number of meetings held.

The proposed elimination would do away with the 2½- and 3½-in. sizes of plain round conductor pipe, as well as the 3,- 3½- and 4½-in. sizes of eaves troughs, and the No. 0 angle of conductor pipe elbows.

Equipment and Materials

Automatic Truck Loader

For loading motor trucks the Acme Foundry & Machinery Co., Coffeyville, Kan., has placed on the market an automatic loader in the form of a pivoted arm carrying a skip which is filled at ground level by slip scrapers or other devices and then raised through an arc of 90 deg. to a point of discharge into the truck. After a slip scraper, drawn by a team of horses, is dumped into the skip, the overturned scraper automatically engages a hook on a steel track and the horses, moving forward, raise the load by means of a cable connected to the

gear shaft of the lift arm. The loader weighs 1,900 lb. and has a lifting capacity of one ton. Both the ground frame and the slip track are constructed of riveted angle irons, the length from the front of the skip to the end of the track being 15 ft. A spring breaks the fall of the skip when the latter is returned to the loading position after having discharged into the truck.

The device, its manufacturer states, is adapted to all kinds of grading and road work, loading asphalt, excavating drainage ditches, gravel pits or basements.

New Portable Flight Conveyor

For handling coal and other loose or lumpy material the Gifford-Wood Co., Hudson, N. Y., has placed on the market a new portable flight conveyor having a capacity of 1 ton per minute when fed continuously. The equipment is 24 ft. long, mounted on a pair of 48x4-in. wheels, has a trough 20 in. wide, and weighs 2,580 lb. It may be driven either by a 3-hp. electric motor or a 5-hp. gasoline engine.

The main drive, from the top or discharge end, is by steel roller chain. The flights are all of heavy steel channels and the trough plate is in sections bolted to the bottoms of the channels forming the side frame. The supporting frame is of pipe and angle construction.

Geared lifting mechanism regulates the slope of the conveyor and the height of discharge. Lubrication throughout is by the pressure system using a grease gun. The conveyor is designed

particularly for use in unloading hopper-bottom cars, loading from ground storage or truck, or transferring loose material of all kinds from one place to another.

Traffic Line Marker

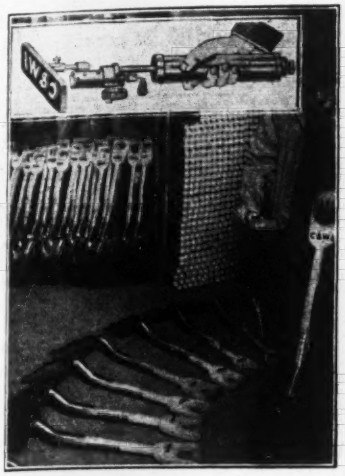
For marking highway traffic lines on pavements the Simons Paint Spray Brush Co., Dayton, Ohio, has developed a mechanical marking machine consisting of an 8-gal paint reservoir mounted on a frame carried by three roller-bearing, rubber-tired disk wheels and operated by compressed air from a pipe line to a portable 1½-hp. gasoline driven air compressor. The width of line marked on the street may be varied from 3 to 6 in., the control being by means of two steel plate shields that are shifted in grooves to produce the width of marking desired.

The paint container has an air pipe extending through the top to a point 2 or 3 in. from the bottom, ending in a T from which the escaping air agitates the liquid, keeping the pigment in suspension. A pressure of 4 or 5 lb. per square inch is normally employed for traffic-marking work. The spray brush is controlled through two coupled bell cranks by means of a trigger on the right handle of the machine, so that the

operator can start or stop the flow of paint instantly. With this machine, its manufacturer states, 5 gal. of paint will mark a line 5 in. wide and 1 mile long.

Branding Tool for Equipment

To prevent loss or theft of such construction equipment as shovels, picks, wheelbarrows, wooden horses, scaffolding, plank, and other tools and materials, the Everhot Manufacturing Co., Maywood, Ill., has placed on the market a gasoline branding tool which is convertible into a soldering iron and blow

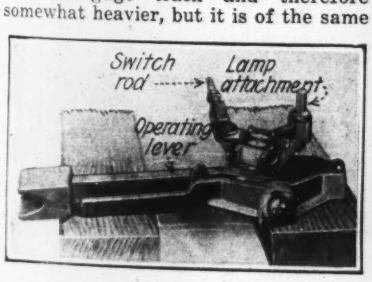


torch. The tool is made in several sizes having gasoline holding capacities of from ½ pt. for a single-burner outfit to 1½ gal. for a three-burner outfit. For the branding operation the tool is equipped with a holder with slots to receive the letters or numbers desired. The letters and numerals are interchangeable. In addition, the company is prepared to furnish a die of any special design carrying a trade mark or other special device. For soldering work a number of special tips are available.

The gasoline supply is held in the handle of the tool and the feed is through a needle valve. A cotton wick supplies fuel to the burner.

Low Switchstand for Freight Yard

An exceptionally low parallel-throw switchstand for yard work has been developed by the Bethlehem Steel Co., Bethlehem, Pa., from a design which it made during the World War to meet the requirements of the U. S. Army for material for the narrow-gage light railways built on the French front. That design, No. 1217, had to be not more than 3 in. high and with all working parts above the ties. The newer design, No. 1222, is for ordinary standard-gage track and therefore somewhat heavier, but it is of the same type and only 4¼ in. high overall, or lower than an ordinary heavy rail. Its weighted operating lever moves parallel with the track and the device occupies so little space that at complicated or confined locations, as at station platforms, it may be placed between the rails.



A special feature is that no lever latch is required, since the operating crank is on a dead center with the lever in either position of throw; this arrangement saves time in operation and is of particular importance for fast work in yard switching. Locking lugs on the base casting enable the lever to be padlocked in either position. The operating mechanism consists of only three moving parts: the lever, the crank lug and the sliding block. This block is the part most subject to wear, but when worn it can be turned so as to present new wearing surfaces. An adjustable crank of the screw-eye type provides for an adjustment of 3½ to 6 in. throw of the switch points and provision is made for the attachment of a lamp, with target above or on the lamp case. Some of these switchstands now in yard service are operated 600 to 800 times a day.

Shock Insulators for Motor Truck Spring Shackles

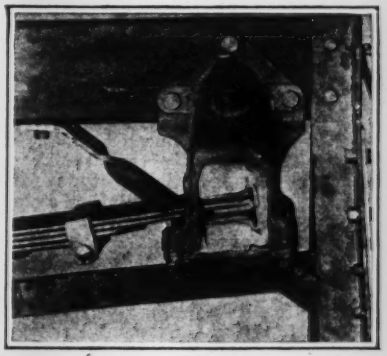
In passing over even an ordinary roadway, innumerable shocks are transmitted to the anchors and shackles of the suspension springs on motor trucks. This action squeezes the lubricant from between the bearing surfaces, and before it can flow back the shocks are repeated. Spring shackles are often among the first parts of the chassis to require replacement. To check this need of replacement the International Motor Co., maker of Mack trucks, has developed rubber shackles or shock insulators, described recently in a paper before the Society of Automotive Engineers by A. F. Masury, the company's chief engineer.

The shock insulators consist of slotted blocks of moulded, resilient rubber, in the openings of which the ends of the springs are embedded. Instead of the customary eyes in the ends of each spring, the top leaf is merely bent

double and inserted and riveted in place between two concave pressed steel plates which act as retaining guides for the upper and lower sections of the insulators. The complete shackle is then compressed in a cast steel box which forms a part of the spring bracket. This box replaces the conventional spring bracket, and a bolted cap holds the assembly in position. Being completely housed, shackles of this type are not affected by either road or weather conditions. Furthermore, they permit thorough cleaning, and therefore, do not offer the unsightly appearance of the oily metal shackles.

No lubrication is needed for the spring ends when the shock insulators are used. Their serviceable life is from 150,000 to 200,000 miles of truck travel.

In motor truck operation, Mr. Masury states, springs or shackles are rebushed and pins replaced every 10,000 or 15,000 miles. This entails a cost of from $90 to $125 per year per vehicle, not in-



cluding the cost of lubricant and labor. The rubber shackle eliminates this expense, and assuming its life to be 100,000 miles under the most strenuous conditions, it will last from seven to ten times as long with a proportional saving.

Publications from the Construction Industry

Portable Loaders—LINK BELT CO., Chicago, has issued a 40-p. book covering its complete line of industrial loaders, which includes the "Cub" portable belt conveyor, the "Grizzly" power-swiveling loader which runs on either crawler treads or traction wheels, and standard types of bucket loader for handling coals, sand, gravel, stone, fertilizer and similar materials.

Snow Plows—BAKER MFG. CO., Springfield, Ill., features its snow plow equipment for motor trucks and tractors in a 48-p. illustrated catalog. The main features of the auto truck plows, which are made with blades of either 8 or 10 ft., are a safety tripping device, a universal axle clamp, and a self-locking lifting device. Both straight blades and V-shaped blade models are made. In the line is included a trip blade plow, designed especially for attachment to a Fordson tractor.

Tile Roofing Machines—CONCRETE TILE MACHINERY CO., Cicero, Ill., has published a 15-p. illustrated pamphlet describing its power machines for making roofing tile of concrete.

Power Shovels—PAWLING & HARNISCHFEGER CO., Milwaukee, features its gasoline and electric power shovels in a 34-p. illustrated bulletin just issued.

After detailed descriptions of the company's ¾ and 1-yd. models, in which emphasis is laid on a special form of crowding motion, text and pictures show the applications of the shovels in a number of fields, including road and street work, sand and gravel pit work, clay and clay products manufacture, building and basement work, and the logging industry.

Blowers—BUFFALO FORGE CO., Buffalo, N. Y., in a 16-p. illustrated booklet, reviews the use of electric fans for blowing, exhausting, ventilating, cooling and drying. The subject matter is confined to direct-connected units, including descriptions of small disk or propeller fans, multiblade type fans used for heating and ventilating, stoker units, pressure blowers, mill exhausters and electric forge blowers. The booklet is illustrated with views of installations in various types of industrial plants.

Street Lighting — GENERAL ELECTRIC CO., Schenectady, N. Y., has issued a 32-p. bulletin on street lighting transformers, describing various types of constant current transformers, both indoor and outdoor and for pole or subway mounting. It includes also individual lamp series transformers, cutouts, transformer controls and protective devices.

Wells and Pumps—LAYNE & BOWLER CO., Memphis, Tenn., in a 64-p. illustrated catalog, describes its well water systems and vertical turbine pumps for operating them. The text deals first with a number of typical installations. Later chapters describe well screens, including the Layne patent shutter screen in which the metal is bent to form hoods over the slitted openings and Keystone screens consisting of perforated pipe wrapped with bronze or galvanized steel wire. Details of the company's vertical centrifugal well pumps are given; these units are built in sizes of from 100 to 5,000 gal. per minute to operate against heads ranging from 25 to 1,000 ft. The catalog concludes with a section devoted to engineering data, comprising a table of equivalents for water measurement, a weir table, curves showing centrifugal pump characteristics, and a chart indicating the cost of pumping water by electric power.

Rock Crushers—SMITH ENGINEERING WORKS, Milwaukee, are distributing a new 19-p. illustrated pamphlet on the Telsmith primary breaker and also the reduction crusher for intermediate crushing. A feature of the primary breakers is an all-steel frame and crown guaranteed against breakage even by tramp iron. These machines are built in sizes with outputs ranging from 12 to 300 tons per hour.

Cranes—BYERS MACHINE CO., Ravenna, Ohio, has issued two pieces of new trade literature. One is a new 24-p. bulletin featuring the Byers' Model 10 crane, described as a full revolving crane of 10 tons capacity, the largest crane of the Byers line. The second bulletin is a new 16-p. treatise on the Truckrane, a light crane furnished unmounted for mounting on a motor truck chassis.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

British Imports of Building Materials

Increased imports in all items of building materials brought into the United Kingdom during July, 1924, are observed on comparison with the records for the same month in 1923, says Robert B. Macatee, American consul at London, in a report to the Department of Commerce.

Notable increases are to be observed in the importation of bricks and tiles. The imports of stones and slates were practically double those of July, 1923; the imports of tubes, pipes and fittings were also double. Imports of pig and sheet lead were more than doubled. Imports of this item from the United States amounted to 5,122 tons as against 1,153 tons in July, 1923, and 175 tons in July, 1922.

Imports into the United Kingdom during the month of July for the past three years are shown in the following tabulation:

Materials	July, 1922	July, 1923	July, 1924
Bricks, thousands	.....	210	14,123
Floor tiles for tesselated pavements and mosaics, cwts.	232	.....	.....
Glazed wall and hearth tiles, cwts.	2,237	4,526	9,615
All other tiles (roofing: street, etc.), cwts.	20,297	23,917	84,304
Plate and sheet glass, cwts.	59,732	57,244	79,945
Cement for building and engineering, tons	13,050	14,714	15,948
Stones and slates, wholly or partly manufactured (granite), tons	5,066	16,580	32,471
Tubes, pipes and fittings- cast, tons	1,999	995	3,360
wrought, tons	1,417	1,939	2,674
Lead, pig and sheet:			
From Spain, tons	5,616	3,737	3,310
From U. S., tons	175	1,153	5,122
From Mexico, tons	411	1,109	2,891
From Australia, tons	6,119	3,127	6,211
From other countries, tons	2,738	2,886	7,092
Total (average)	15,059	12,012	24,536

Business Briefs

Call money listed at 2½ per cent, Oct. 11.

Time loans; short terms, 2½@3 per cent; longer periods, 3¼ per cent.

Commercial paper; best names, 3@3½ per cent; other names, 3½ per cent.

Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 211 to 222, are the following.

Clubhouse, New York, N. Y., Knights of Columbus, to McEntee & Sperling, $1,650,000.

Piers and bridge approaches, Pittsburgh, Pa., Dept. of Pub. Wks. to Foundation Co., New York City, $1,577,299.

Hotel, Cincinnati, O., Hotel Alms Co., to Ferro Concrete Constr. Co., $1,000,000.

Apartment, New York, N. Y., A. Campagna, by day labor, $1,000,000.

Theatre, Columbus, O., B. F. Keith Theatrical Enterprises, N. Y. City, to M. Shapiro, Cleveland, $1,000,000.

Hotel, Quebec, Que., Canadian Pacific R.R. to Anglin-Norcross Co., Ltd., $3,000,000.

Electric Street Railway, York Twp., Ontario, to Toronto Transportation Comn., $1,000,000.

Foreign Projects Awarded to American Contractors

The accompanying table gives definite information concerning the foreign contracts awarded to American contracting firms in 1923 and 1924. The three tables previously published appeared in the issues of *Engineering News-Record* dated April 20, June 15 and Oct. 12, 1922. This table brings the foreign work to date so far as information is available.

CONTRACTS AWARDED TO AMERICAN FIRMS IN FOREIGN COUNTRIES

Name and Address of Contractor	Kind of work	Where Located	Cost	Date of Contract	Name of Owner
Beckman & Linden Engr. Corp., Santa Fe Bldg., San Francisco	20 mi. street car track and equipment	Harbin, Manchuria, China	$3,000,000	Feb. 22, 1923	Municipal
MacDonald Eng. Co., 53 West Jackson Blvd., Chicago, Ill.	Grain elevators	Bulgaria	10,000,000	May 24, 1923	Government
Utah Constr. Co., Phelan Bldg., San Francisco, Calif.	85 miles of railroad and tunnels	Mexico	6,000,000	June 7, 1923	Southern Pacific R.R. Co
James B. Stewart & Co., 30 Church St., N. Y. C.	Bank and Office Bldg.	Tokio, Japan	7,500,000	March 8,1924	Mitsui Co.
C. A. Bayley & Co., Interstate Bank Bldg., New Orleans, La.	3 million gal. filter plant, sanitation work	Forteleaza, Clara, Brazil	1,500,000	March 27, 1924	Municipal
The Foundation Co., 120 Liberty St., N. Y. C.	(a) 50 miles of underground electric ry.	Tokio, Japan	82,000,000	April 22, 1924	Municipal
	(b) Modern sewer and water works in 32 cities	Peru, S. A.	50,000,000	May 27, 1924	Government
George E. Nolan, Inc., 50 East 42d St., N. Y. C.	Offices and Streets	Buenos Aires, Argentine, S. A.	35,000,000	May 24, 1924	Municipal
Westinghouse Electric Internationa Co., 165 Broadway, N.Y.C.	Electrification of railroads	Japan	1,500,000	June 15, 1924	Imperial Gov't Railways of Japan
Ulen and Co., 120 Broadway, N. Y. C.	Buildings and gen. impt.	Angora, Angora Republic, Turkey	2,000,000 to 3,000,000	June 15, 1924	Turkish Gov't
R. W. Hebard & Co., Inc., 40 Rector St., N. Y. C.	Water works, sewers, paving	San Salvador El Salvador	6,000,000	July 14, 1924	Republic of El Salvador

Wage Rates Have Not Curtailed Building Construction

"During the early months of last year it was freely predicted that any general wage increases granted to the building trades would immediately result in the slowing down of the entire construction industry," according to A. W. Dickson, Executive Secretary of the National Association of Building Trades Employers. "A careful analysis of the situation," states the Secretary, "reveals that although wages began to climb in April, 1923, and continued to do so until July of this year, there has been no general depression in the industry, but rather a marked improvement of conditions has been the result."

The report further states that, "while labor costs have been on the increase since April, 1923, and are now approximately 20 per cent higher than the average for the past five years, materials costs have become stabilized and since Sept., 1923, have only shown a range that has been within the compass of 5 per cent. Material costs are now about 10 per cent under the average for the past five years. This is, no doubt, one of the determining factors in the building boom that is sweeping the country.

"Another important consideration to be born in mind when arriving at the reasons for the activity of the construction industry is the fact that high wages have resulted in increased purchasing power. Reports show that nearly 50 per cent of the building done during the past two years has been residential, a situation that is only made possible through the prosperity of the wage earners.

"The upward trend of wages has stopped and present rates will no doubt prevail until the early part of next year. Whether there will be a tendency on the part of the trades to seek additional raises during 1925 or whether the leaders will content themselves with holding them at the present level is difficult to determine at this time."

In connection with Mr. Dickson's report it will be noted that the *Engineering News-Record* Construction Cost Index Number, which includes labor cost, was 222 for September, 1923. By March of the current year, however, the Number had advanced to 225, a gain of 1 per cent. The Number for the current month is 208, a drop of 6 per cent below the March peak. The Cost Index of 208 for October, 1924 is also exactly the same as the average for the five years 1919 to 1923, inclusive.

To appear soon in this section: An analysis of commercial building contracts awarded in New York City during the first nine months of 1924.

Bids Wanted on Big Jobs

Among the projects in Construction News, pp. 211 to 222, on which bids are either asked or will soon be called, are the following:

Loft, New York, N. Y., Milliner Center Bldg. Corp., $3,500,000.

Apartment, New York, N. Y., A. A. Paterno, $1,300,000.

Museum, Providence, R. I., Rhode Island School of Design, $1,000,000.

Livestock Exchange Building, Omaha, Nebr., Union Stock Yards Co., $1,000,000.

Public Bond Sales in September

The aggregate of $82,516,350 for state and municipal bonds issued in September is the smallest for any month so far this year as reported by *The Commercial and Financial Chronicle*. This figure is the smallest monthly total in fact, since September, 1923, when issues for $56,398,075 were recorded.

New York State marketed an issue of $12,000,000 for state buildings. State of Mississippi sold refunding bonds for $2,400,000. The American Falls Reservoir District, Idaho issued bonds for $2,489,000. The remaining bonds were for amounts less than $2,000,000.

In the accompanying table, three issues sold at par, while one went below par, the remainder commanding premiums. The rates ranged from 4 to 6 per cent.

REPRESENTATIVE PUBLIC BOND SALES, SEPTEMBER, 1924

State	Purpose	Amount	Rate per Cent	Sold For	Basis	Dated	Maturity	Purchased By
Kansas	Compen. Bonds	$1,000,000	4½	105.80	4.15	Oct. 1	1952—3	Kean, Taylor & Co. and others
New York	State buildings	12,500,000	4	103.4167	3.64	Sept. 1	1925—49	Seyer & Co. and others
Mississippi	Refunding bonds	2,400,000	4½	101.163	4.37	Oct. 1	1935—38	Lehman Bros. and others
County								
Allen, Ind.	Roads	11,500	5	103.05	4.37	Aug. 25	1925—34	J. F. Wild & Co.
Benton, Ind.	Highway	26,867	4½	100.05	4.48	Sept. 3	1925—34	J. F. Wild & Co.
Blue Earth, Minn.	Roads	100,000	5	102.10	4.5	Oct. 1	.....	National Citizens Branch of Mankato
Carter, Tenn.	Roads	1,000	..	100	....	Aug. 1	1949	Caldwell & Co.
Clay, Miss.	Highway	40,000	5	100.51	4.93	.....	1925—44	David Robinson & Co.
Carroll, O.	Road	50,000	5	102.11	4.54	Sept. 1	1925—34	.....
Collier, Fla.	Highway	275,000	6	98.31	6.20	Sept. 1	1926—44	Bank of Everglades
Darke, O.	Construction	25,000	5½	102.42	4.54	Sept. 1	1925—29	W. L. Slayton & Co.
Gilliam, Ore.	Road	75,000	5½	100.08	5.24	Aug. 1	1949	Blyth, Witter Co.
Grant, Ore.	Road	25,000	5	101.02	4.93	Aug. 1	1951	Blyth, Witter Co.
Hancock, Ind.	Road	9,000	5	104.33	4.10	Sept. 10	1926—35	Citizens Bank of Greenfield
Hancock, O.	Road	19,500	5	102.09	4.53	Sept. 1	1925—34	W. L. Slayton & Co.
Henry, O.	Road	189,500	5	102.68	4.485	Sept. 15	1926—34	William R. Compton Co.
Hocking, O.	Road	50,000	5	102.19	4.52	Oct. 1	1925—34	Ryan Bowman & Co.
Hudson, N. J.	Bldgs. and bridge	2,000,000	4½	102.085	4.32	Sept. 15	1925—54	First Nat. Bk. of Jersey City
Hidalgo, Tex.	Flood control	1,600,000	..	100	....	.....	.....	J. L. Arlitt & Co.
Howard, Ind.	Road	19,784	4½	101.01	4.29	Sept. 15	1925—34	Howard Nat. Bank
Lincoln, Wyo.	Court House	100,000	5½	100.05	5.24	Sept. 1	Sept.,1944	U. S. National Co.
Los Angeles, Calif.	Hospital	1,000,000	5	105.05	4.48	July 1	1928—47	Dean, Witter & Co.
Lucas, O.	Highway	406,750	5½	103.07	4.545	Sept. 5	1925—31	R. M. Grant & Co.
Marshall, Ind.	Road	11,200	4½	100.56	4.385	Sept. 3	1925—34	Meyer-Kiser Bank of Indianapolis
Marshall, Tenn.	Road	40,000	5	102.01	4.84	Aug. 1	1944	American Nat. Co.
Township								
Allen, O.	Road	22,000	5½	100.94	5.19	Sept. 15	1925—29	Ryan, Bowman & Co.
Cranberry, O.	Road	13,000	5½	100.53	5.37	Sept. 1	1925—33	Farmers' State Bank of New Washington
Victoria, Ill.	Bridge	5,000	5	100	....	Sept. 1	1925—29	White-Phillips Co.
Municipal								
Attleboro, Mass.	School and sewer	134,000	4	100.2673	3.94	Sept. 1	1925—31	Putnam & Stores
Agawam, Mass.	Bridge	66,000	4	100.449	3.945	Oct. 1	1925—44	L. L. Day & Co.
Atlanta, Kan.	Electric Line	18,000	5	100	....	Sept. 15	1928—45	Branch-Middlekauf Co.
Bastrop, Ia.	Sewers	125,000	6	102	5.83	Sept. 1	1925—64	Caldwell & Co.
Birmingham, Ala.	Public Library	640,000	5	100.78	4.94	Oct. 1	1925—54	Ward Sterne & Co. and others
Boston, Mass.	Pub. improvement	2,140,000	4	100.299	3.97	Oct. 1	1925—44	R. L. Day & Co.
Buffalo, N. Y.	Pub. improvement	1,980,000	4½	103.861	3.90	Oct. 1	1925—44	First Nat. Bk. of Detroit and others
Binghamton, N. Y.	Improvement	1,365,500	4½	101.88	4.09	.....	1925—44	A. B. Leach & Co.
Cottage Grove, Ore.	Sewer	25,000	5	100.11	4.99	Oct. 1	1925—44	Geo. H. Burr & Co. and others
Dallas, N. C.	Sidewalk	30,000	5½	100.01	5.74	Sept. 1	1926—44	Spitzer, Rorick & Co.
Davidson, N. C.	Streets and water	50,000	6	102.405	5.72	July 1	1926—50	Kinsey & Co.
Fairfield, Ala.	Street improvement	30,000	6	102.87	5.62	Aug. 1	1934	First Nat. Bank
Fredonia, N. Y.	Water system	75,000	4½	101.40	4.35	Oct. 1	1925—49	E. H. Rollins & Sons
Findlay, O.	Improvement	149,075	5–5½	100.01	5.60	Mar. 1	1925—35	Seasongood & Mayer
Flint, Mich.	Improvement	1,249,000	4½	100.81	4.42	Sept. 15	1925—54	E. H. Rollins & Sons and others
Glendale, Calif.	Sewers	652,000	5	104.15	4.66	Mar. 1	1926—61	Bank of Italy
Hartford, Conn.	Water system	300,000	4	101.62	3.87	Oct. 1	1925—36	Roy T. H. Barnes & Co.
Indianapolis, Ind.	Flood prevention	900,000	4½	104.19	4.145	July 1	1926—55	Fletcher Savings & Trust Co. and others
Johnstown, Pa.	Sewer building	500,000	4½	101.043	4.17	Aug. 1	1925—54	Lewis & Snyder
Kenmore, N. Y.	Street paving	89,000	4½	100.81	4.15	Sept. 9	1925—29	State Bank of Kenmore
Lynn, Mass.	Improvement	305,000	4	100.978	3.80	Sept. 1	1925—29	Estabrook & Co.
Lyndhurst, O.	Street improvement	57,250	5½	100.73	5.595	Oct. 1	1925—34	Milliken & York Co
Madison, Fla.	Street improvement	89,000	6	102.24	4.97	Oct. 1	1925—34	Prudden & Co.
Melrose, Mass.	Sewer	70,000	4	100.721	3.91	Sept. 1	1925—44	Geo. A. Fernald & Co.

Chamber of Commerce Seeks Ruling on Trade Statistics

In an effort to secure an official ruling to clearly define the legal rights of trade associations in collecting and distributing statistics and other activities, a committee representing the Chamber of Commerce of the United States visited Attorney General Stone, Secretary of Commerce Hoover and members of the Federal Trade Commission in Washington, Sept. 22.

The results of a referendum undertaken by the National chamber last year on trade association functions, together with supporting and explanatory data, were laid before the Federal officials. No effort was made to secure an expression of opinion from the officials at the meetings Sept. 22 but they were asked to study the data presented them and to meet the Chamber's committee again late in October,

Each of eight proposals defining in rather general terms the proper scope of trade association functions laid before its membership by the Chamber of Commerce of the United States last year was given overwhelming approval.

According to Richard F. Grant, of Cleveland, newly elected president of the Chamber of Commerce of the United States, it is the belief of officials of that organization that a trade association functioning along the lines laid down in the chamber's policy is clearly within the law. So much has been said recently, however, regarding the "twilight zone" of association activities in regard to the Sherman anti-trust law, and there being no clear-cut judicial decision marking the line between legal and illegal activities, that conferences with the Federal officials were sought in order to obtain, if possible, an official opinion which would form the basis of procedure.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of October 2, the next, on November 6.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.34	$3.80	$4.15	$3.10	$3.35	$4.00	$3.00	$3.35	$3.50
Structural rivets, 100 lb.	3.75	4.35	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.30	3.38	3.00	3.25	3.87½	3.35	3.25	3.25
Steel pipe, black, 2½ to 6 in. iap, discount	44%	54.2%	43%	53%	55.05%	36%	36.80@49.10%	45%	37.83
Cast-iron pipe, 6 in. and over, ton.	56.60@57.60	54.00	—57.00	56.20@57.20	55.50	68.00	56.00	65.00	65.00
Concreting Material:									
Cement without bags, bbl.	.2.50@2.60	2.35	2.05	2.20	2.42	2.84	2.61	2.90	1.80
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	2.75	1.85	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.75	1.75	3.50	2.15	3.00	2.25
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	55.00	35.00	57.20	55.00	37.75	34.75	29.00	26.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.60	24.00	21.00
Lime common, lump, per bbl.	2.50@3.00	1.45	1.85	1.50	1.40	2.70	2.15	2.80	10.50
Common brick, delivered, 1,000	+18@19	11.00	—11.90	12.00	14.00	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.1004	.0941	.089	.07	.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.1004	.0941	.089	.....	.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal.	+1.05	+1.11	1.20	1.05	+1.10	+1.18	1.14	1.12	—1 13
Common Labor:									
Common labor, union, hour	.75	.30	.....	.82½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour.	....	.25	.40@.75	.75	.50@.55	.35@.50	.50	.62½	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.96). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $37.83.

Conditions Affecting the Market

The trend of construction cost has been steadily downward since May of this year. The recent firmness in the wholesale commodities market, however, has extended to building materials. Linseed oil and brick are the firmest items on the list and c.-i. pipe is the only material showing any indication of weakness.

The three most significant features of the current market are the record car loadings, the gain in unfilled steel tonnage and the increased output of steel ingots.

The steel figures indicate increased demand, while the heavy car loadings show that reserve stocks are being drawn upon, since production has been slow of late in most of the basic industries.

More carloads of grain, grain products, miscellaneous freight, general merchandise and less-car-lot materials were moved during the week of Sept. 27, than were ever loaded during any other single week on record, according to the American Railway Association.

Unfilled orders on books of the U. S. Steel Corp., Sept. 30, amounted to 3,473,780 tons, against 3,289,577, on Aug. 31 and 5,035,750 tons on Sept. 30, 1923.

The steel ingot output for September, as calculated by the American Iron and Steel Institute, reached 2,814,996 tons, against 2,541,501, for the month preceding and 3,356,776, during the corresponding period last year. The total for the first nine months of 1924 is 26,874,941 tons and that for the same period last year, 33,910,987 tons.

Telegraphic reports to *Engineering News-Record* from the Seattle district state that Puget Sound lumber mills increased operations during the week to the extent of exceeding the maximum output attained at any time during the past ninety days.